

HP StorageWorks

Command View XP User Guide for Main Frames

Legal and notice information

© Copyright 1999–2005 Hewlett-Packard Development Company, L.P.

Hewlett-Packard Company makes no warranty of any kind with regard to this material, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Hewlett-Packard shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

This document contains proprietary information, which is protected by copyright. No part of this document may be photocopied, reproduced, or translated into another language without the prior written consent of Hewlett-Packard. The information is provided "as is" without warranty of any kind and is subject to change without notice. The only warranties for HP products and services are set forth in the express warranty statements accompanying such products and services. Nothing herein should be construed as constituting an additional warranty. HP shall not be liable for technical or editorial errors or omissions contained herein.

Java™ is a U.S. trademark of Sun Microsystems, Inc.

Microsoft®, MS-DOS®, MS Windows®, Windows®, and Windows NT® are U.S. registered trademarks of Microsoft Corporation.

Oracle® is a registered U.S. trademark of Oracle Corporation, Redwood City, California.

UNIX® is a registered trademark of The Open Group.

Printed in the U.S.A.

Command View XP for Main Frames User Guide

Contents

About this guide	19
Intended audience	19
Prerequisites	19
Related documentation	19
Document conventions and symbols	20
HP technical support	21
HP-authorized reseller	21
Helpful web sites	21
1 TrueCopy for the XP128/XP1024/XP12000	23
Other Data Duplication Features	23
Business Copy XP and ShadowImage	24
Hitachi Extended Remote Copy	24
Continuous Access XP	25
Overview of TrueCopy Operations	25
Components	26
XP128/XP1024/XP12000	27
Control Units (MCUs and RCUs)	30
CU Emulation Types	31
Volume Pairs (M-VOLs and R-VOLs)	31
Remote Copy Connections	32
Initiator Ports and RCU Target Ports	33
Remote Control Ports (RCPs) and Local Control Ports (LCPs)	33
Command View Management Station	34
Asynchronous Consistency Groups	34
Host I/O Time-Stamping Function	34
Error Reporting Communications	35
Remote Copy Operations	35
Initial Copy Operations	35
Update Copy Operations	36
Read and Write I/O Operations for TrueCopy Volumes	36
R-VOL Read Option	37
Difference Management	37
TrueCopy Asynchronous Recordset Operations	38
Creating and Storing Recordsets at the MCU	39
Sending Recordsets to the RCU	39
Storing Recordsets at the RCU	39
Selecting and Settling Recordsets at the RCU	39
Types of Recordsets	40
Inflow Control of Recordsets	40
Graduated Delay Sidefile Management	42
Dummy Pair Mode	43
TrueCopy Asynchronous Consistency Group Operations	44
Group Options	44
Group Consistency Time	45
Group Operations	45
TrueCopy Volume Pair Status	46
TC390A-Specific Pair Status	46
Suspended Pairs	47
Suspended TrueCopy Asynchronous Pairs	50
PPRC Support	51

P/DAS Support	52
Restrictions	52
GDPS Support	52
Preparing for TrueCopy Operations	53
System Requirements	53
Requirements and Restrictions	54
Track Format	55
One-to-One Volume Copy Operations	55
Duplicate VOLSER	55
Logical Volume Image (LVI)	56
Accessing TrueCopy M-VOLs and R-VOLs	56
Cache, NVS, and DASD Fast Write	56
Consistency Groups	57
Installing the TrueCopy Hardware	57
Fibre Remote Copy Connections	58
Serial Remote Copy Connections	60
Channel Extenders for Serial Remote Copy Connections	62
Installing the TrueCopy Software	62
To install the TC390 software:	62
Configuring the MCUs and RCUs for TrueCopy Operations	62
Serial Interface Configuration	63
To configure the MCUs and RCUs for serial-interface TC390 operations:	63
Fibre Channel Interface Configuration	64
To configure the MCUs and RCUs for TC390 Fibre Channel operations:	64
Combining TrueCopy with Other Data Management Operations	66
Combining TrueCopy and ShadowImage	68
Starting TrueCopy	70
To access TC390:	70
Performing TrueCopy Configuration Operations	71
TrueCopy Main Window	72
TrueCopy Main Window (Pair Operations Window)	74
Volume List	75
Display Filter	76
Snapshot Function	78
To create a TC390 snapshot file:	78
RCU Operations Window	78
CU Number Tree and MCU/RCU List	79
Port Tree and Port List	81
Asynchronous Operations Window	82
Usage Monitor Window	84
Script Operations Window	84
History Window	86
Other Operations Window	88
RCU Operations	88
To perform the RCU operations from the RCU Operations tab:	89
Configuring the Host Interface Ports	90
To configure the Fibre Channel or serial ports:	91
Viewing RCU Status (RCU Status)	91
To display the RCU status information:	91
Registering an RCU (Add RCU)	93
To register an RCU to the connected MCU:	95
RCU Path Parameters	96
Modifying RCU Options (Change RCU Option)	98
To modify the RCU option:	101
Deleting an RCU (Delete RCU)	101
To delete an RCU from an MCU:	101
Adding and Deleting Logical Paths for an RCU (Add Path and Delete Path)	101
To add a new logical path from the connected MCU to an existing RCU:	102
To delete a path from the connected MCU to an existing RCU:	103

Adding and Deleting SSIDs for an RCU (Add SSID and Delete SSID)	104
To add or delete an SSID for an existing RCU:	104
Modifying Parameters and Omitting Selected Settings	105
To modify the parameters:	105
To omit the RCUs, Paths, or SSIDs from the operation:	106
Asynchronous Operations	106
To perform the asynchronous operations:	106
Viewing Consistency Group Status (CT Group Status)	107
To display the consistency group status information:	107
Adding Consistency Groups (Add CT Group)	109
To add a consistency group:	110
Modifying Consistency Group Options (CT Group Option)	110
To change the group options:	111
Deleting Consistency Groups (Delete CT Group)	112
To delete a consistency group from an MCU:	112
Asynchronous Copy Option	112
To set the asynchronous option parameters:	113
Modifying Parameters and Omitting Consistency Groups	113
To modify the parameters:	113
To omit the consistency groups: from the operation.	114
Usage Monitor Operations	114
Starting and Stopping Monitoring	114
To start monitoring:	114
To stop monitoring:	114
Displaying the Usage Monitor Graph	115
To display the usage monitor graph:	115
To close the graph:	116
Script Operations	118
History Operations	118
Other Operations	118
To clear all remote copy SIMs from the disk array:	118
Optimizing TrueCopy Operations and Disk Array Performance	118
Discontinuing TrueCopy Operations	119
To discontinue all TC390 operations:	120
Performing TrueCopy Pair Operations	120
Preparing for TrueCopy Volume Pair Operations	120
Common Procedure for TrueCopy Pair Operation	121
To perform the pair settings operation:	121
List after the Command Selection	122
Modifying Parameters and Omitting Selected Volumes	122
To modify the parameters of a volume:	123
To omit the selected volumes:	123
Viewing the Status of TrueCopy Volume Pairs (Pair Status)	123
To display the TC390 pair status information:	123
Creating TrueCopy Volume Pairs (Add Pair)	126
To create one or more new TC390 volume pairs:	131
Suspending TrueCopy Pairs (Suspend Pair)	132
To suspend one or more TC390 volume pairs:	134
Resuming TrueCopy Volume Pairs (Resume Pair)	134
To resume one or more split or suspended TC390 volume pairs:	136
Deleting TrueCopy Volume Pairs (Delete Pair)	137
To delete one or more TC390 volume pairs:	139
Changing the Pair Options (Change Pair Option)	140
To change the pair options for one or more TC390 volume pairs:	141
ICKDSF Considerations for TrueCopy Volumes	142
ICKDSF on a TrueCopy M-VOL	142
To perform ICKDSF on a TC390 M-VOL:	142
ICKDSF on a TrueCopy R-VOL	142
To perform ICKDSF on a TC390 R-VOL:	142

Using TrueCopy for Data Migration and Duplication	143
Data Migration Using TrueCopy Synchronous	143
To use TC390 Synchronous to migrate data from one volume to another:	143
Point-in-Time (PiT) Data Duplication Using TrueCopy Asynchronous	144
To produce a PiT duplicate of an existing TC390A consistency group:	144
Powering Off/On TrueCopy Components.	144
Planned Outage of the MCU	145
To maintain a fully consistent group at the RCU during the planned MCU outage:	145
Planned Outage of the RCU or Remote Copy Connection	145
To perform a planned outage of a TC390 RCU or remote copy connection component:	145
Planned Outage of the MCU and RCU	145
To perform a planned outage of a TC390 MCU and RCU:	146
TrueCopy Disaster Recovery Operations	146
Preparing for Disaster Recovery.	146
Considering the M-VOL Fence Level Setting	147
Transferring Sense Information Between Sites	148
File and Database Recovery Procedures	148
CSUSPEND/QUIESCE TSO Command	149
IEA494I System Console Message	149
Switching Operations to the Remote Site.	149
Analyzing the Currency of TrueCopy Synchronous R-VOLs	150
Analyzing the Consistency of TrueCopy Asynchronous R-VOLs	151
Transferring Operations Back to the Main Site.	151
To transfer operations to the main site:	151
Resuming Normal Operations at the Main Site	152
To resume normal operations at the main site:	152
Troubleshooting	153
General TrueCopy Troubleshooting	153
TrueCopy Software Error Codes	160
Using PPRC Commands for TrueCopy	160
Overview of PPRC Commands.	160
Using PPRC TSO Commands with TrueCopy Asynchronous.	163
CESTPATH	164
CESTPAIR	166
CSUSPEND	168
CDELPAR	169
CRECOVER	170
CQUERY for Serial Interface.	171
CQUERY for Fibre Channel Interface.	173
CGROUP (FREEZE/RUN) Support	174
Requirements	174
CGROUP (FREEZE/RUN) Command	176
Using the CGROUP Command.	177
Using PPRC TSO Commands with CGROUP Support.	178
IEA494I and IEA491E Console Messages	180
IEA494I Message	181
IEA491E Message	181
XP128/XP1024/XP12000 Response Characteristics to Failure Conditions	182
GDPS-TC390-HXRC Matrix	185
Pinned Track Recovery for TrueCopy Volumes	189
SIM Reporting	190
TrueCopy Scripting	195
Overview of Scripting	195
Syntax for Scripting	197
Syntax Overview	197
Script File Requirements.	198
Script Symbols	199
Operation Macro Commands	199
Create Pairs.	199

Delete Pairs	202
Suspend Pairs	203
Resume Pairs	204
Change Pair Options	205
Starting a Pair	206
Getting Pair Status	206
Selecting Devices	207
Internal Macro Commands	209
Internal Macro Command Definitions	209
AddList	209
Delay	209
End	209
If/EndIf	210
MakeString	211
SetList	211
Start	211
Work Variables	212
Reserved Variables	212
Reserved Result Variables	212
Reserved Status Variables	213
Optional Script Parameters	215
Error Reporting	218
HXRC Device Blocking and Load Balancing	225
Device Blocking Function	225
Load Balancing Control	226
Current Load Balancing Control	226
New Load Balancing Control	227
2 ShadowImage for the XP128/XP1024/XP12000	231
ShadowImage Components	231
Volume Pairs (S-VOLs and T-VOLs)	231
IBM PPRC Host Software Functions	232
ShadowImage Requirements	233
Requirements on the Maximum Number of Pairs	234
ShadowImage Operations	235
Setting/Resetting Reserve Attribute Operation	235
Add Pair Operation	236
Initial Copy Operation	236
Update Copy Operation	236
Split Pair Operation	237
Resynchronize Pair Operations (Normal, Quick, Reverse, Quick Restore)	238
Forward Pairresync Operation	238
Backward Pairresync Operation	239
Pair Status and the Time Required for Pairresync	241
Suspend Pair Operation	242
Delete Pair Operation	242
ShadowImage Options	243
Swap&Freeze Option	243
Host I/O Performance Option	244
At-Time Split Function	244
To use the SI390 At-Time Split function by executing the PPRC TSO commands:	245
ShadowImage Pair Status	246
Cautions on Switching Off the Power Supply	249
Preparing for ShadowImage Operations	250
System Requirements	250
Preparing for ShadowImage Operations	250
Combining ShadowImage with Other Data Management Operations	251
Combining ShadowImage and TrueCopy Operations	252
Combining ShadowImage for z/OS (SIz) with Universal Replicator for z/OS (URz)	254

Starting ShadowImage	257
To start SI390:	257
ShadowImage Main Window	258
The Volume List Box	260
The Detail Window	262
The Display Filter Window	263
The Preset Volume List Box	264
FlashCopy Information Pane	265
Performing ShadowImage Operations	266
Setting the Reserve Attribute	266
To reserve one or more volumes for use as SI390 S-VOLs (set the reserve attribute):	267
Resetting the Reserve Attribute	267
To unreserve one or more volumes (reset the reserve attribute):	268
Adding ShadowImage Pairs	268
To add one or more new SI390 pairs:	270
Splitting ShadowImage Pairs	271
To split one or more existing SI390 pairs:	272
Adding and Splitting Pairs	272
To add and split one or more new SI390 pairs with a single Command View operation:	273
Resynchronizing ShadowImage Pairs	273
To resynchronize one or more SI390 pairs:	274
Suspending ShadowImage Pairs	275
To suspend one or more SI390 pairs:	276
Deleting ShadowImage Pairs	277
To delete one or more SI390 pairs:	277
Viewing the Past Record of Pair Operations	278
Setting ShadowImage Options	280
To set an SI390 option:	280
CTG Window	281
The CTG List Box	282
The CT Group Status Window	282
Setting the Reserve Attribute of a Consistency Group	283
To set the reserve attribute of one or more consistency groups:	284
Resetting the Reserve Attribute of a Consistency Group	284
To reset the reserve attribute of one or more consistency groups:	284
Using PPRC Commands for ShadowImage	284
PPRC Command Support	284
PPRC Restrictions	291
PPRC Commands with ShadowImage and TrueCopy	292
PSF and DEVSERV Commands	293
Adding Pairs: CESTPAIR and PPRCOPY ESTPAIR	294
Displaying Pair Status: CQUERY, PPRCOPY QUERY, DEVSERV	294
Splitting Pairs: CSUSPEND and PPRCOPY SUSPEND	297
CSUSPEND QUIESCE Parameter	298
Resynchronizing Pairs: MODE(RESYNC) Parameter	299
Deleting Pairs: CDELPAIR and PPRCOPY DELPAIR	299
Setting and Resetting the At-Time Split Time: ATSPLIT	300
Displaying the Status of the Consistency Group: ATQUERY	301
Using ShadowImage - FlashCopy	302
Overview of ShadowImage - FlashCopy	302
ShadowImage - FlashCopy Pair Status	303
Establishing ShadowImage - FlashCopy Pairs	303
Combining ShadowImage - FlashCopy With Other Copy Solutions	306
Using ShadowImage - FlashCopy Host Commands	307
DFSMSdss Command Support	308
TSO Command Support	309
To copy one or more dataset using the TSO (FCESTABL) command:	310
Adding ShadowImage - FlashCopy Pairs: FCESTABL	311
Deleting ShadowImage - FlashCopy Pairs: FCWITHDR	311

Displaying ShadowImage - FlashCopy Pair Status: FCQUERY	311
Cautions on Switching Off the Power Supply When Using ShadowImage - FlashCopy	312
Troubleshooting	312
General ShadowImage Troubleshooting	312
ShadowImage Error Window	313
Using Compatible Mirroring for IBM FlashCopy Version2	313
Overview of Compatible Mirroring for IBM FlashCopy Version2	314
Functionalities of Compatible Mirroring for IBM FlashCopy Version2	315
Establishing Multiple Relationships	316
Specifying COPY mode or NOCOPY mode	316
Volume Copying and Dataset Copying	317
Maximum Number of FlashCopy Mirror Version 2 Pairs	318
Installing and Uninstalling Compatible Mirroring for IBM FlashCopy Version2	324
Installing Compatible Mirroring for IBM FlashCopy Version2	324
Uninstalling Compatible Mirroring for IBM FlashCopy Version2	325
Establishing Compatible Mirroring for IBM FlashCopy Version 2 Pairs	326
Combining Compatible Mirroring for IBM FlashCopy Version 2 With Other Copy Solutions	326
Combining Compatible Mirroring for IBM FlashCopy Version 2 With Other Solutions	328
Using Compatible Mirroring for IBM FlashCopy Version 2 Host Commands	328
DFSMS Command Supported by Compatible Mirroring for IBM FlashCopy Version 2	329
Creating FlashCopy Mirror Version 2 Pairs by Volume Copying	329
Creating FlashCopy Mirror Version 2 Pairs by Dataset Copying	330
DFSMSdss Copy Command Options	330
Deleting FlashCopy Mirror Version 2 Pairs	331
TSO Command Supported by Compatible Mirroring for IBM FlashCopy Version 2	331
Creating FlashCopy Mirror Version 2 Pairs: FCESTABL	333
Procedure for Volume Copying	334
Procedure for Dataset Copying	334
Withdrawing FlashCopy Mirror Version 2 Pairs: FCWITHDR	335
Displaying Information on FlashCopy Mirror Version 2 Pairs: FCQUERY	345
Cautions on Switching Off the Power Supply When Using Compatible Mirroring for IBM FlashCopy Version 2	346
Suspending FlashCopy Mirror Version 2 Pairs	347
Relationship Between Compatible Mirroring for IBM FlashCopy and Compatible Mirroring for IBM FlashCopy Version 2	347
Differences Between IBM FlashCopy and Compatible Mirroring for IBM FlashCopy Version 2	349

3 HPAV for the XP128/XP1024/XP12000 351

Overview of HPAV Operations	351
Components	351
Base Devices and Alias Devices	351
Controller Emulation Type	352
Command View-based HPAV	352
HCD Definitions for the XP128/XP1024/XP12000 HPAV Devices	352
WLM Host Software Definitions for Dynamic Alias Management	353
Static and Dynamic HPAV Operations	353
Static HPAV	354
Dynamic HPAV	354
Requirements and Restrictions	355
Maximizing Your HPAV Results	356
Preparing for HPAV Operations	357
System Requirements	357
Preparing the XP128/XP1024/XP12000 for HPAV Operations	358
Changing the Controller Emulation Type	358
Enabling the HPAV Options	358
Preparing the Host System for HPAV Operations	358
Setting the WLM Operation Mode	358
Setting the MIH Timer Value	359
To set the MIH timer value:	359

Starting HPAV	359
To access HPAV:	359
HPAV Window	359
Performing HPAV Operations.	360
Assigning and Canceling Aliases.	360
Assigning Aliases	360
To assign aliases to volumes in the connected XP128/XP1024/XP12000:	361
Canceling Aliases.	362
To cancel aliases for volumes in the connected XP128/XP1024/XP12000:	362
Considerations for Defining the XP128/XP1024/XP12000 Devices to the Host System	363
Definition of XP128/XP1024/XP12000 Base and Alias Devices	363
Verifying Base and Alias Device Definition.	364
Verifying the Status of the Devices.	364
To verify the status of the XP128/XP1024/XP12000 devices by CHP ID:	364
Monitoring HPAV Activities	365
Additional MVS Commands	365
GTF I/O Tracing	366
Using HCD to Define and View XP128/XP1024/XP12000 LCUs and HPAV Devices	369
Using HCD to Define an XP1024/XP12000 LCU and the Base and Alias Devices.	369
Displaying HPAV Device Parameters	379
Checking the WLM PAV Settings	383
4 SANtinel - S/390 for the XP128/XP1024/XP12000.	387
Overview of SANtinel Operations	387
System Requirements	387
Protecting Logical Volumes from I/O Operations at Mainframe Hosts.	387
Enabling Only the Specified Hosts to Access Logical Volumes	387
Prohibiting All Hosts from Accessing Logical Volumes	389
Protecting Logical Volumes from Erroneous Remote Copy Operations.	390
Restrictions and Cautions	390
Volume emulation types (or device emulation types)	391
PCB types	391
Maximum possible number of security groups, host groups, and LDEV groups	391
TrueCopy (TC390) or ShadowImage (SI390) users	391
VSC volumes	391
HPAV users	391
Removing secured logical volumes	391
Removing PCBs with secured ports	392
Starting SANtinel	392
To access SANtinel:	392
SANtinel Window	392
Security Group tree	392
Hosts table	393
LDEVs table	394
Buttons	394
Applying and Disabling Security	394
Enabling Only the Specified Hosts to Access Logical Volumes	395
Creating a Host Group	395
To create a host group:	395
Registering Hosts in a Host Group	396
To register hosts in a host group:	396
Registering Ports in a Host Group	397
To register ports in a host group:	397
Creating an LDEV Group	398
To create an LDEV group:	398
Registering Logical Volumes in an LDEV Group.	398
To register logical volumes in an LDEV group:	398
Creating a Security Group for Use As an Access Group	399
To create a security group and classify the group as an access group:	399

Registering a Host Group and an LDEV Group in a Security Group	400
To register a host group and an LDEV group into a security group:	400
Prohibiting All Hosts from Accessing Logical Volumes	401
Creating a Security Group for Use As a Pool Group	401
To create a security group and classify the group as a pool group:	401
Registering an LDEV Group in a Security Group	402
To register an LDEV group into a security group:	402
Protecting Logical Volumes from Remote Copy Operations	403
To make logical volumes in a security group unusable as secondary volumes:	403
Disabling Security	404
To disable security on logical volumes:	404
Editing Security Settings	405
Editing Security Groups	405
Unregistering a Host Group from a Security Group	405
To unregister a host group from a security group:	405
Unregistering an LDEV Group from a Security Group	405
To unregister the LDEV group from a security group:	405
Renaming Security Groups	406
To rename a security group:	406
Deleting Security Groups	406
To delete a security group:	406
Editing Host Groups	407
Registering Hosts to be Attached to the Disk Array	407
To register a mainframe host to be attached into a host group:	407
Tips	408
Deleting Hosts from Host Groups	408
To delete hosts from a host group:	408
Deleting Ports from Host Groups	409
To delete ports from a host group:	409
Renaming Host Groups	410
To rename a host group:	410
Deleting Host Groups	411
To delete a host group:	411
Editing LDEV Groups	411
Deleting Logical Volumes from LDEV Groups	411
To delete logical volumes from an LDEV group:	411
Renaming LDEV Groups	412
To rename an LDEV group:	412
Deleting LDEV Groups	413
To delete an LDEV group:	413
Viewing Security Settings	413
Finding Logical Volumes in a Specified Security Group	414
To find logical volumes in a specified security group:	414
Finding Security Groups that Contains a Specified Host	415
If the host is displayed in the Hosts table:	415
If the host is not displayed in the Hosts table:	415
Finding Ports Through which Hosts Can Access Logical Volumes	415
To find the ports through which a host can access logical volumes:	416
Finding Logical Volumes in the Security Group that Contains a Specified Host	416
If the host is displayed in the Hosts table:	416
If the host is not displayed in the Hosts table:	417
Finding Security Groups that Contain a Specified Logical Volume	417
If the logical volume is displayed in the LDEVs table:	417
If the logical volume is not displayed in the LDEVs table:	418
Finding Hosts in the Security Group that Contains a Specified Logical Volume	418
If the logical volume is displayed in the LDEVs table:	418
If the logical volume is not displayed in the LDEVs table:	419
Finding Security Groups that Contain a Specified Host Group	419
To find security groups in which the specified host group is registered:	419

Finding Security Groups that Contain a Specified LDEV Group	420
To find security groups in which the specified LDEV group is registered:	420
General SANTinel Troubleshooting	421
To find the cause of the error:	422
5 LDEV Guard for the XP128/XP1024/XP12000	423
Assigning Access Attributes to Logical Volumes	423
Using Pattern Files	424
Using LDEV Guard with Other Products	425
Requirements for LDEV Guard	426
Java Web Start	426
Starting LDEV Guard	426
To start LDEV Guard:	426
LDEV Guard Window	427
LDEV Guard Pattern tree	427
Download/Upload button	427
Detail table	427
LDEV Guard Error Window	428
Using LDEV Guard	429
Changing Access Attributes of Logical Volumes	429
To change access attributes of logical volumes:	429
Creating a Pattern File	429
To create a pattern file:	430
Editing a Pattern File	430
To edit a pattern file:	430
Applying a Pattern File to the Disk Array	431
To apply a pattern file to change access attributes of all logical volumes:	431
Renaming a Pattern File	431
To rename a pattern file:	431
Deleting a Pattern File	431
To delete a pattern file:	431
Downloading a Pattern File	431
To download a pattern file:	432
Uploading a Pattern File	432
To upload a pattern file:	432
Specifying the VTOC Size	433
To specify the size of the VTOC in a logical volume:	433
Index	435
Figures	
1 TrueCopy components for serial (ESCON) connection	27
2 TrueCopy components for Fibre Channel connection	27
3 TrueCopy remote copy operations	35
4 Selecting and settling TrueCopy Async recordsets at the RCU	40
5 Graduated delay process for sidefile management	42
6 Dummy pair mode	43
7 Fibre Channel remote copy connection configurations	58
8 Fibre Channel interface direct connection (NL port)	59
9 Fibre Channel interface switch connection (FL port or F port)	59
10 Fibre Channel interface extender connection	60
11 Serial remote copy connection configurations	60
12 N pairs of remote copy connections	61
13 N-to-1 and 1-to-n remote copy connections (n≤4)	61
14 Remote copy connections shared with channel-to-RCU connections	62
15 Setting the Async options	63
16 Adding the consistency groups	64
17 Add the RCUs	65

18	Configuring the RCU options	65
19	Setting the Async options	66
20	Adding the consistency groups	66
21	TrueCopy and ShadowImage: shared M-VOL/S-VOL	69
22	TrueCopy and ShadowImage: shared R-VOL/S-VOL	69
23	TrueCopy and ShadowImage: shared M-VOL/S-VOL and R-VOL/S-VOL	69
24	TrueCopy and ShadowImage: shared M-VOL/T-VOL	70
25	TrueCopy main window	70
26	TrueCopy main window (Pair Operations window)	74
27	Volume list	75
28	Display Filter window	77
29	Example of snapshot file	78
30	RCU Operations window	79
31	RCU Operations window with the MCU&RCU option button selected	80
32	RCU Operations window with the Port option button selected	81
33	Standard speed, two ports per row	82
34	High-speed (2 port), two ports per row	82
35	High-speed, four ports per row	82
36	Asynchronous Operations window	83
37	Usage Monitor window	84
38	Script Operations window	85
39	Script Operations window during execution of a script file	86
40	History Operations window	87
41	Other Operations window	88
42	MCU/RCU list with the RCU Status command	91
43	RCU Status window	92
44	Add RCU windows (Fibre and Serial)	94
45	MCU/RCU list with the RCU Operation command	95
46	Typical TC390 remote copy configuration with two paths	96
47	Add RCU window – serial interface	97
48	Fibre Channel interface connections going through switches	97
49	Add RCU window – FC interface	98
50	RCU Option window (Change RCU Option)	99
51	Add Path window (for Fibre)	102
52	Opening the Add Path window	103
53	Add SSID window	104
54	Opening the Add SSID window	105
55	Consistency Group list	107
56	CT Group Status window	108
57	Add CT Group window	109
58	CT Group Option window	111
59	Async Option window	112
60	Selecting data for Usage Monitor Graph	115
61	TrueCopy main window (Pair Operations window)	122
62	Pair Status window	124
63	Add Pair (Synchronous) window	126
64	Add Pair (Asynchronous) window	127
65	Suspend Pair window (Asynchronous)	132
66	Resume Pair window	135
67	Delete Pair window (Asynchronous)	138
68	Change Pair Option window (Asynchronous)	140
69	Example of the TC390 error message	160
70	Overview of GDPS operations	178
71	Failure conditions (described in Table 38)	182
72	Typical XP128/XP1024/XP12000 SIM showing reference code and SIM type	191
73	Result statement format	213
74	Scripting error code format	218
75	Current load balancing control	226
76	Combination 1: MODE 85,86 = ON,OFF; Threshold 1/2/3 = 30/40/50%	228

77	Combination 2 (Default): MODE 85,86 = OFF,OFF; Threshold 1/2/3 = 40/50/60%	228
78	Combination 3: MODE 85,86 = OFF,ON – Threshold 1/2/3 = 50/60/70%	229
79	Combination 4: MODE 85,86 = ON,ON – Threshold 1/2/3 = 60/70/80%	229
80	ShadowImage for z/OS configuration	231
81	Adding a pair	236
82	Update Copy operation	237
83	Forward pairresync operations	239
84	Backward pairresync operations	239
85	Quick Restore operation with or without Swap&Freeze option	244
86	Outline of the At-Time Split function	245
87	ShadowImage pair status transitions	246
88	SI390 and TC390: shared S-VOL/M-VOL	253
89	SI390 and TC390: shared S-VOL/R-VOL	253
90	SI390 and TC390: shared S-VOL/M-VOL and S-VOL/R-VOL	254
91	SI390 and TC390: shared T-VOL/M-VOL	254
92	Slz and URz: Shared S-VOL/P-VOL	256
93	Slz and URz: Shared S-VOL/S-VOL	256
94	Slz and URz: Shared S-VOL/P-VOL and S-VOL/S-VOL	257
95	ShadowImage main window	257
96	Volume List box	260
97	Detail window	262
98	Detail Filter window	263
99	Preset Volume List box displaying settings (operations)	264
100	FlashCopy Information pane	265
101	Set Reserve Attribute window	266
102	Reset Reserve Attribute window (unreserve)	267
103	Add Pair Dialog window	269
104	Split Volume Pair window	271
105	Resynchronize Volume Pair window	274
106	Suspend Volume Pair window	276
107	Delete Volume Pair window	277
108	History window	278
109	Options window	280
110	CTG window	281
111	CTG List Box	282
112	CT Group Status window	283
113	ShadowImage - FlashCopy pair status transition	303
114	Possible combination of ShadowImage - FlashCopy and Slz and SI390 pairs	305
115	ShadowImage - FlashCopy and TCz: shared T-VOL and M-VOL/R-VOL (not allowed)	307
116	Copying All Datasets Using DFSMSdss Command	308
117	Copying Specified Dataset by Specifying EXTENTS Parameter Using TSO (FCESTABL) Command	310
118	Examples of FlashCopy Mirror Version 2 Pairs Created Between Extents	314
119	Example of the Case FlashCopy Mirror Version 2 Pair Cannot be Created	315
120	Examples of Multiple Relationships	316
121	On-demand Copying	317
122	Overlap of Copy Source Extents	318
123	Copying Data in Two Extents that do not Overlap (One T-VOL)	321
124	Copying Data in Two Extents that do not Overlap (Two T-VOLs)	321
125	Copying Data in Two Extents that do not Overlap (Two S-VOLs)	321
126	Copying Data in Three Extents that Overlap (One T-VOL)	321
127	Copying Data in Two Extents that Overlap (Two T-VOLs)	322
128	Copying One Extent to Another in the Same Volume	322
129	Referential Example for Calculating the Number of Pairs	324
130	Example of devserv Command	325
131	Pair Configuration Where an S-VOL of FlashCopy Mirror Version 2 and Slz is Shared	326
132	Cases When FlashCopy Mirror Version 2 and Slz Cannot be Used in Conjunction	328
133	Example of DFSMSdss Command (COPYFULL)	329
134	Copying All Datasets Using DFSMSdss Command "COPYFULL"	330
135	Example of DFSMSdss Command (COPY DS)	330

136	Copying a Dataset by Using TSO (FCESTABL) Command with EXTENTS Parameter Specified	333
137	Copying a Dataset by Using TSO (FCESTABL) Command with XTNTLTS Parameter Specified	334
138	Example of FCESTABL Command (NOCOPY)	335
139	Example of FCESTABL Command (COPY)	335
140	Example of FCWITHDR Command Description (for Case 1)	337
141	Example of FCWITHDR Command (TDEVN: specified, DDSW = NO)	337
142	Example(1) of FCWITHDR Command Description (for Case 2)	338
143	Example(1) of FCWITHDR Command (TDEVN: specified, DDSW = NO, XTNTLST parameter specified)	338
144	Example(2) of FCWITHDR Command Description (for Case 2)	338
145	Example(2) of FCWITHDR Command (TDEVN: specified, DDSW = NO, XTNTLST parameter specified)	339
146	Example of FCWITHDR Command Description (for Case 3)	339
147	Example of FCWITHDR Command (TDEVN: specified, DDSW = NO)	340
148	Example(1) of FCWITHDR Command Description (for Case 4)	340
149	Example(1) of FCWITHDR Command (SDEVN and TDEVN: specified, DDSW = NO, XTNTLST parameter specified)	341
150	Example(2) of FCWITHDR Command Description (for Case 4)	341
151	Example(2) of FCWITHDR Command (TDEVN: specified, DDSW = NO, XTNTLST parameter specified)	342
152	Example(3) of FCWITHDR Command Description (for Case 4)	342
153	Example of FCWITHDR Command Description (for Case 5)	343
154	Example of FCWITHDR command (SDEVN and TDEVN: specified, DDSW = YES)	343
155	Example of FCWITHDR Command Description (for Case 6)	343
156	Example of FCWITHDR Command (SDEVN and TDEVN: specified, DDSW = YES, XTNTLST parameter specified)	344
157	Example of FCQUERY Command Description	345
158	Example of FCQUERY Command Execution Result	345
159	Calculation Example of the Number of the Pairs Displayed in "ACT"	346
160	Static HPAV	354
161	Dynamic HPAV	355
162	HPAV window	359
163	Assigning aliases	361
164	Confirming new aliases	362
165	Canceling aliases	363
166	Security example 1	388
167	Security example 2	389
168	Security example 3	390
169	SANtinel window	392
170	Add/Change Host Group window	395
171	Add/Change Host window	396
172	Select Port window	397
173	Add/Change LDEV Group window	398
174	Select LDEV window	399
175	Add/Change Security Group window	400
176	Specify Security Group window	401
177	Add/Change Security Group window	402
178	Specify Security Group window	403
179	Add/Change Security Group window	403
180	Add/Change Security Group window	404
181	Add/Change Security Group window	406
182	Add/Change Host window	408
183	Add/Change Host window	409
184	Select Port window	410
185	Add/Change Host Group window	410
186	Select LDEV window	412
187	Add/Change LDEV Group window	413
188	Security Group to LDEV window	414
189	Host to Security Group window	415

190 Host Group to Port window	416
191 Host to LDEV window	417
192 LDEV to Security Group window	418
193 LDEV to Host window	419
194 Host Group to Security Group window	420
195 LDEV Group to Security Group window	421
196 Error Detail window	421
197 Example of a pattern.	424
198 Example of using pattern files.	425
199 LDEV Guard window	427
200 LDEV Guard Error window.	428
201 Enter Pattern Name window	430
202 Download/Upload Pattern File window (Download tab)	432
203 Download/Upload Pattern File window (Upload tab)	433
204 VTOC Area window	434

Tables

1 Document conventions	20
2 HXRC path configuration with FICON	25
3 XP128/XP1024/XP12000 modes for TrueCopy (and HXRC)	28
4 TC390 configuration with FICON	33
5 Operation of the unit of data stored in bitmap.	38
6 Maximum number of pairs possible for the basic LU type	38
7 Sidefile thresholds	41
8 Differences between TC390A dummy pair mode and HPAV	43
9 TrueCopy volume pair status	47
10 Suspend types.	48
11 Consistency status for suspended TrueCopy Async R-VOLs	49
12 TrueCopy Asynchronous suspension conditions	50
13 Requirements and restrictions for combining TrueCopy and HXRC	67
14 Host pair status reporting for TrueCopy/ShadowImage shared volumes	68
15 Data currency of a shared TrueCopy/ShadowImage volume.	68
16 TC390 functions	72
17 Logical path status	93
18 I/O statistics	116
19 Optimizing TrueCopy operations and XP128/XP1024/XP12000 performance.	119
20 Fence level setting on a TrueCopy M-VOL.	147
21 Analyzing the currency of TrueCopy Synchronous R-VOLs.	150
22 Analyzing the consistency of TrueCopy Asynchronous R-VOLs	151
23 Selecting the correct timer type for TrueCopy Async disaster recovery	152
24 General TrueCopy troubleshooting	154
25 Troubleshooting RCU path status problems	155
26 Troubleshooting suspended TrueCopy pairs	157
27 Resolving TrueCopy Asynchronous suspension conditions	159
28 TrueCopy operations versus PPRC TSO and ICKDSF commands	161
29 Typographic conventions for PPRC TSO commands	164
30 CESTPATH LINK parameter for serial and Fibre Channel	165
31 SAID values for the CESTPATH LINK parameter.	166
32 Using CESTPAIR to establish and resume TrueCopy Async pairs	167
33 Using CSUSPEND to suspend TrueCopy Async pairs	169
34 Using CDELPAR to delete TrueCopy Async pairs/groups at the MCU	170
35 Using CRECOVER to delete TrueCopy Async pairs/groups at the RCU	171
36 CQUERY output for serial and Fibre Channel	174
37 TrueCopy pair status during CGROUP (FREEZE/RUN) operations	177
38 XP128/XP1024/XP12000 response characteristics to failure conditions	182
39 GDPS-TC390-HXRC matrix	186
40 TrueCopy control unit SIMs	191
41 TrueCopy device SIMs	191
42 Functional macro commands for TrueCopy scripting.	196

43	Internal macro commands for TrueCopy scripting.	197
44	Syntax description	197
45	Script components	198
46	Script file requirements	198
47	Script symbols	199
48	Example of CreateHrcPair parameters	201
49	Select device parameters	207
50	Internal macro commands.	209
51	ASCII character codes	210
52	If/EndIf comparison symbols	210
53	MakeString expression definitions	211
54	Work variables	212
55	Reserved result variables.	213
56	Reserved status variables	213
57	Syntax requirements for optional parameters.	215
58	Error messages	219
59	TrueCopy scripting error codes	219
60	ShadowImage for z/OS requirements	233
61	Number of Pairs That Can Be Created With Volumes of Each Emulation Type and Capacity.	234
62	Reverse and quick restore Pairresync requirements.	240
63	Types of ShadowImage options.	243
64	Pair status versus allowable operations.	247
65	ShadowImage for z/OS pair status	247
66	Sample table for ShadowImage configuration information	250
67	Host pair status reporting for SI390/TC390 shared volumes.	252
68	Currency of a shared SI390 and TC390 volume	252
69	Host pair status reporting for SIz/URz shared volumes	255
70	Currency of a shared SIz and URz volume	255
71	Displayed information in progress	260
72	Parameters displayed in Relation(s)	261
73	List of ShadowImage pop-up menu commands.	261
74	Check Boxes in FlashCopy V2 Relations	265
75	ShadowImage status and history reference codes and messages	278
76	FlashCopy Mirror Version 2 status and history reference codes and messages	279
77	List of pop-up menu commands for CTG operation	282
78	PPRC commands	284
79	TSO command parameters	285
80	ICKDSF command parameters.	289
81	Restrictions for PPRC commands	291
82	Accepting PPRC commands.	292
83	PSF command operability for ShadowImage volumes	293
84	PSF and DEVSERV results for ShadowImage volumes	293
85	Pair status reported by the host for volumes in multiple pairs	296
86	Path status displayed by the CQUERY TSO and PPRCOPY QUERY DSF commands	297
87	QUIESCE parameter requirements for ShadowImage	298
88	Parameters of ATSPILT command	300
89	Description of the ATQUERY command examples	301
90	Requirements for ShadowImage - FlashCopy	302
91	ShadowImage - FlashCopy pair status condition	303
92	Pair Status versus allowable operations	304
93	Relationship between L1 pair status and L2 pair operations.	305
94	Relationship between L2 pair status and L1 pair operations.	306
95	ShadowImage - FlashCopy and TC390 shared volume.	306
96	ShadowImage - FlashCopy and XRC shared volume.	307
97	PPRC TSO commands.	309
98	PPRC TSO command parameters	310
99	Status displayed by FCQUERY command	312
100	General ShadowImage troubleshooting	312
101	Requirements for FlashCopy Mirror Version 2.	315

102	Compatibility between FlashCopy Mirror Version 2 and User Interface Functions	318
103	Number of Relations That Can Be Established With Volumes of Each Emulation Type and Capacity . .	319
104	Referential Examples for Calculating the Number of Resources Required to Create the FlashCopy Mirror Version 2 Pairs	322
105	Relationship Between FlashCopy Mirror Version 2 Pair and Operation of the Copy Solutions.	327
106	Relationship Between Slz Pair Status and FlashCopy Mirror Version 2 Operations	327
107	Compatibility of Volumes Shared by FlashCopy Mirror Version 2 and Security Solutions	328
108	FASTERREPLICATION Parameter Values	331
109	PPRC TSO Commands Supported by FlashCopy Mirror Version 2	331
110	Parameters of PPRC TSO Commands Supported by FlashCopy Mirror Version 2	332
111	Parameters of FCWITHDR Command and Applicable Combinations.	335
112	Information Displayed by FCQUERY Command	345
113	Differences Between FlashCopy Mirror and FlashCopy Mirror Version 2	347
114	Differences Between IBM FlashCopy and Compatible Mirroring for IBM FlashCopy Version 2	349
115	HCD settings for static and dynamic HPAV	353
116	Requirements and restrictions for HPAV	355
117	Ratio of base devices to alias devices	357
118	Security group icons for SANtinel operations	393
119	Add/Change Host window icons	396
120	Supported volume emulation types	423
121	LDEV Guard icons	427

About this guide

This guide provides information about:

- Using the administration features to manage:
 - User profiles and disk array sessions
 - Applications installed on Command View management station
 - Disk arrays added to Command View
- Viewing recent disk array events and error conditions
- Displaying identity and status information about disk arrays
- Accessing additional help and support information
- Managing the HP StorageWorks XP Disk Array XP48, XP128, XP512, XP1024, and XP12000

Intended audience

This guide is intended for customers and HP authorized service providers experienced with:

- Disk array hardware and software
- Storage systems

Prerequisites

Prerequisites for using this product include:

- Install or upgrade to most recent version of Command View XP
- Set up the HP StorageWorks XP disk arrays
- Install Path Connectivity
- See the `readme.txt` file on the CD for last minute announcements

Related documentation

In addition to this guide, please refer to other documents for this product:

- *HP StorageWorks Command View XP Installation Guide*
- *HP StorageWorks Command View XP Path Connectivity User Guide*
- *HP StorageWorks Command View XP Path Connectivity Command Line Interface (CLI) Reference Guide*
- *HP StorageWorks Command View XP Command Line Interface (CLI) Reference Guide*

- Command View XP and Path Connectivity online help

These and other HP documents can be found on an HP web site: <http://www.docs.hp.com>.

Document conventions and symbols

Table 1 Document conventions

Convention	Element
Medium blue text: Figure 1	Cross-reference links and e-mail addresses
Medium blue, underlined text (http://www.hp.com)	Web site addresses
Bold font	<ul style="list-style-type: none"> • Key names • Text typed into a GUI element, such as into a box • GUI elements that are clicked or selected, such as menu and list items, buttons, and check boxes
<i>Italics font</i>	Text emphasis
Monospace font	<ul style="list-style-type: none"> • File and directory names • System output • Code • Text typed at the command-line
<i>Monospace, italic font</i>	<ul style="list-style-type: none"> • Code variables • Command-line variables
Monospace, bold font	Emphasis of file and directory names, system output, code, and text typed at the command-line



WARNING! Indicates that failure to follow directions could result in bodily harm or death.



CAUTION: Indicates that failure to follow directions could result in damage to equipment or data.



IMPORTANT: Provides clarifying information or specific instructions.



NOTE: Provides additional information.



TIP: Provides helpful hints and shortcuts.

HP technical support

Telephone numbers for worldwide technical support are listed on the HP web site:
<http://www.hp.com/support/>.

Collect the following information before calling:

- Technical support registration number (if applicable)
- Product serial numbers
- Product model names and numbers
- Applicable error messages
- Operating system type and revision level
- Detailed, specific questions

For continuous quality improvement, calls may be recorded or monitored.

HP strongly recommends that customers sign-up online using the Subscriber's choice web site at
<http://www.hp.com/go/e-updates>.

- Subscribing to this service provides you with email updates on the latest product enhancements, newest versions of drivers, and firmware documentation updates as well as instant access to numerous other product resources.
- After signing-up, you can quickly locate your products by selecting **Business support** and then **Storage** under Product Category.

HP-authorized reseller

For the name of your nearest HP-authorized reseller:

- In the United States, call 1-800-345-1518.
- Elsewhere, visit <http://www.hp.com> and click **Contact HP** to find locations and telephone numbers.

Helpful web sites

For third-party product information, see the following vendor web sites:

- <http://www.hp.com>
- <http://www.hp.com/go/storage>
- <http://www.hp.com/support/>
- <http://www.docs.hp.com>

1 TrueCopy for the XP128/XP1024/XP12000

TrueCopy (TC390) creates and maintains remote copies of the S/390 data stored on the XP128/XP1024/XP12000 for data duplication, backup, and disaster recovery purposes. TC390 provides synchronous and asynchronous copy modes to accommodate a wide variety of user requirements and data copy/movement scenarios. TrueCopy Asynchronous (TC390A) provides a superior hardware-based solution for data duplication, data migration, remote copy, and disaster recovery tasks.



NOTE: In this chapter, the term “TC390” refers to both TrueCopy Synchronous and TrueCopy Asynchronous unless otherwise noted.

TC390 operations are nondisruptive, allowing the main (primary) volume of each TC390 pair to remain online to all hosts for both read and write I/O operations. After operations have been established, TC390 operations continue unattended to provide continuous data backup. For serial interface connection, TC390 operations can be performed across distances of up to 43 km (26.7 miles) using standard ESCON support. For Fibre Channel connection, TC390 operations can be performed across distances of up to 30 km (18.6 miles) using single-mode longwave optical fibre cables in a switch configuration. Long-distance solutions are provided, based on user requirements and workload characteristics, using approved channel extenders and communication lines. TC390 is a key component of HP’s solutions and service offerings.

After hardware connectivity between XP128/XP1024/XP12000 (or between XP128/XP1024/XP12000 and other XP disk arrays) is established, TC390 operations can be performed from Command View and/or from the zSeries and S/390 system software for maximum usability:

- TC390 running under Command View displays detailed TC390 information and performs all TC390 operations. In the event of a system failure or disaster at the main site, the TC390 software also simplifies and expedites disaster recovery procedures. For operating systems that do not support Peer-to-Peer Remote Copy (PPRC) or ICKDSF PPRCOPY commands, TC390 operations are performed using Command View.
- TC390 is functionally compatible with industry-standard IBM Peer-to-Peer Remote Copy (PPRC) host software functions. PPRC TSO commands (or ICKDSF PPRCOPY commands) combined with disaster recovery PTFs may be used to perform TC390 and disaster recovery operations on XP128/XP1024/XP12000. TC390 supports the PPRC/Dynamic Address Switching (P/DAS) host software function so you can use TC390 to relocate volumes nondisruptively. TC390 also supports the PPRC CGROUP TSO command, which is used with IBM’s Geographically Dispersed Parallel Sysplex (GDPS) service offering.

TC390 can be performed in conjunction with ShadowImage (SI390) (see “[Other Data Duplication Features](#)” on page 23) to provide multiple internal copies of TC390 volumes. TC390 also supports the Virtual LVI/LUN and Cache LUN XP features of the XP128/XP1024/XP12000, ensuring that all zSeries and S/390 user data can be protected by TC390 remote copy operations. For more information on combining TC390 with other data management features, see “[Combining TrueCopy with Other Data Management Operations](#)” on page 66.

Other Data Duplication Features

In addition to TC390, the XP128/XP1024/XP12000 provides several other data duplication features that are described below. For more information about these features, contact your HP account support representative.

Business Copy XP and ShadowImage

You can use the Business Copy (BC) XP and SI390 data duplication features to set up and maintain multiple copies of logical volumes within the same XP128/XP1024/XP12000. BC operations for zSeries and S/390 data are performed using the SI390 through Command View and can also be managed using the TSO and/or ICKDSF commands. BC operations for UNIX/PC server-based data are performed using the licensed BC software through Command View or the Raid Manager software on the UNIX/PC server host.

The RAID-protected SI390 duplicates are created within the same XP128/XP1024/XP12000 at hardware speeds. SI390 can be used in conjunction with TC390 to maintain multiple copies of critical data at your primary and/or secondary (remote) sites. For more information on combining TC390 and SI390 operations, see ["Combining TrueCopy and ShadowImage"](#) on page 68.

Hitachi Extended Remote Copy

The Hitachi Extended Remote Copy (HXRC) feature of the XP128/XP1024/XP12000 is functionally compatible with the industry-standard IBM Extended Remote Copy (XRC) host software function and is provided as a program product. HXRC is also compatible with the DFSMS data mover that is common to the XRC environment. HXRC operations are performed in the same manner as XRC operations, by issuing XRC TSO commands from the host system to the XP128/XP1024/XP12000.

This chapter provides disk array-specific HXRC information (for example, SVP modes), but does not cover XRC operations.

SVP modes: For important information on XP128/XP1024/XP12000 SVP modes for HXRC, refer to [Table 3](#) on page 28.

16 session support: The XP128/XP1024/XP12000 must be configured with 3990-6E emulation (no 3380 LVIs) and 256 LDEVs/SSID for 16 session (per disk array) support. APAR OW36948 must be applied. A disk array power cycle is required when the SSID boundary is changed (640256).

Device blocking, load balancing: For important information on HXRC device blocking support and load balancing control, refer to ["HXRC Device Blocking and Load Balancing"](#) on page 225.

Changing from 3990 to 2105: For important information and instructions on changing from 3990 to 2105 emulation for disk arrays with existing HXRC volumes, refer to ["CU Emulation Types"](#) on page 31.

HXRC operations, as well as TC390A operations, use additional cache to store the sidefile queue of asynchronous recordsets. If you are maintaining HXRC pairs and TC390A pairs, verify that your XP128/XP1024/XP12000 has adequate cache installed and available to support your asynchronous remote copy workloads. Contact your HP account support representative to determine how much cache will be needed for your disk array configuration.



NOTE: If the ANTX5123W console message is displayed during the RESUME operation for HXRC pairs, the operation might be unsuccessful. In this case, you must perform the XDELPAR operation to delete the pairs, and then perform the XADDPAR operation to create the pairs again.



NOTE: If the ANTA5107E (RC=9014, REAS=604, or REAS=608) console message is displayed during the XADDPAR operation, the HXRC PP option may not have been installed. Verify that the HXRC PP option is installed and if not, install the HXRC PP option.



NOTE: The HXRC option is only required for the 2105 CU emulation type. You can use HXRC for the 3990 controller emulation type without enabling the HXRC option.

If you use HXRC with FICON, carefully set the path configuration. Refer to the following table.

Table 2 HXRC path configuration with FICON

Application Site Path (System - DKC)	Record Set Transfer Path (System Data Mover - DKC)	For Use
ESCON	ESCON	No
ESCON	FICON	Supported
FICON	ESCON	Not Recommended ¹
FICON	FICON	Supported

1. If you use FICON for the path of application site, you should also use FICON for the path of System Data Mover (SDM) because of the difference in performance between FICON and ESCON.

Continuous Access XP

As an enterprise advantage, the XP128/XP1024/XP12000 can be concurrently connected to zSeries and S/390 and a variety of UNIX-based and PC-server hosts. Contact your HP account support representative for the latest information on platform and version support. You can use the Continuous Access (CA) XP feature to maintain remote copies of the UNIX/PC server data stored on the XP128/XP1024/XP12000. TC390 volumes and CA volumes can exist concurrently in the same XP128/XP1024/XP12000.

Overview of TrueCopy Operations

TC390 provides a storage-based hardware solution for concurrent data duplication, migration, and disaster recovery operations. After TC390 operations are established, remote copies of data are automatically maintained for backup and disaster recovery purposes. TC390 supports both SMS- and non-SMS-managed data, is completely application-independent, and is designed to run unattended. During normal TC390 operations, the main volumes remain online to all hosts and continue to process both read and write I/O operations.

TC390 Synchronous provides:

- Volume-based, real-time data backup and is ideal for high-priority data backup, duplication, and migration tasks. In the event of a disaster or system failure at the main site, the remote (secondary) TC390 Synchronous data can be rapidly invoked to allow recovery at the volume level with an extremely high level of data integrity.

TC390 Asynchronous (TC390A) represents a unique and outstanding disaster recovery solution for large amounts of data that span multiple volumes and even multiple XP128/XP1024/XP12000. TC390A's group-based update sequence consistency solution enables fast and accurate database recovery, even after a "rolling" disaster, without the need for time-consuming data recovery procedures. The TC390A volume groups at the remote site can be recovered with full update sequence consistency, but the updates will be behind the main site due to the asynchronous remote copy operations.

TC390A provides:

- Update sequence consistency for user-defined groups of volumes (such as large databases).
- Protection for write-dependent applications in the event of a disaster.

This overview of TC390 operations describes:

- TC390 components (see page 26)
- TC390 operations (see page 35)

- TC390A recordset operations (see page 38)
- TC390A consistency group operations (see page 44)
- TC390 volume pair status and suspend types (see page 46)
- PPRC support, including P/DAS and GDPS (CGROUP) operations (see page 51)

Components

TC390 operations involve the XP128/XP1024/XP12000 (and/or other XP disk arrays) at the main and remote sites, the physical communications paths between the main and remote disk arrays, and the Command View management station. The main and remote disk arrays must have the same controller emulation. TC390 copies the original online data at the main site to the offline backup volumes at the remote site through the dedicated ESCON and/or Fibre Channel remote copy connections. The Command View management station hosts the TC390 software and provides a user-friendly Windows-based graphical user interface (GUI) for all TC390 functions and operations. The I/O time-stamping host software function, provided by MVS DFSMSdfp, is required for TC390A consistency groups that span multiple disk arrays. Error reporting communications (ERC) is required for effective disaster recovery with TC390.

Figure 1 on page 27 and Figure 2 on page 27 show the TC390 components and their functions. The TC390 components are:

- XP128/XP1024/XP12000
- Main and remote control units (MCUs and RCUs)
- Volume pairs (local M-VOLs and remote R-VOLs)
- TC390A consistency groups
- Host I/O time-stamping function
- Remote copy connections
- Remote control ports (RCPs) and local control ports (LCPs) for serial interface
- Ordinary target ports, initiator ports, and RCU target ports for Fibre Channel interface
- Command View management station with TC390 software
- Error reporting communications



NOTE: You need the additional Shared Memory option to use TC390.

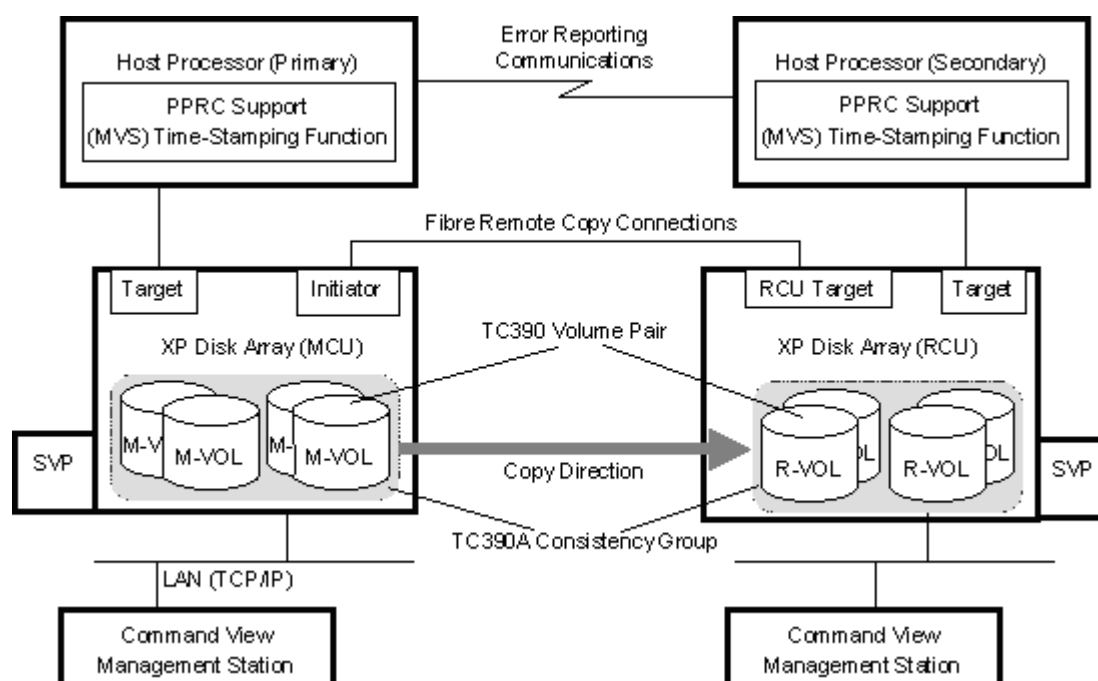


Figure 1 TrueCopy components for serial (ESCON) connection

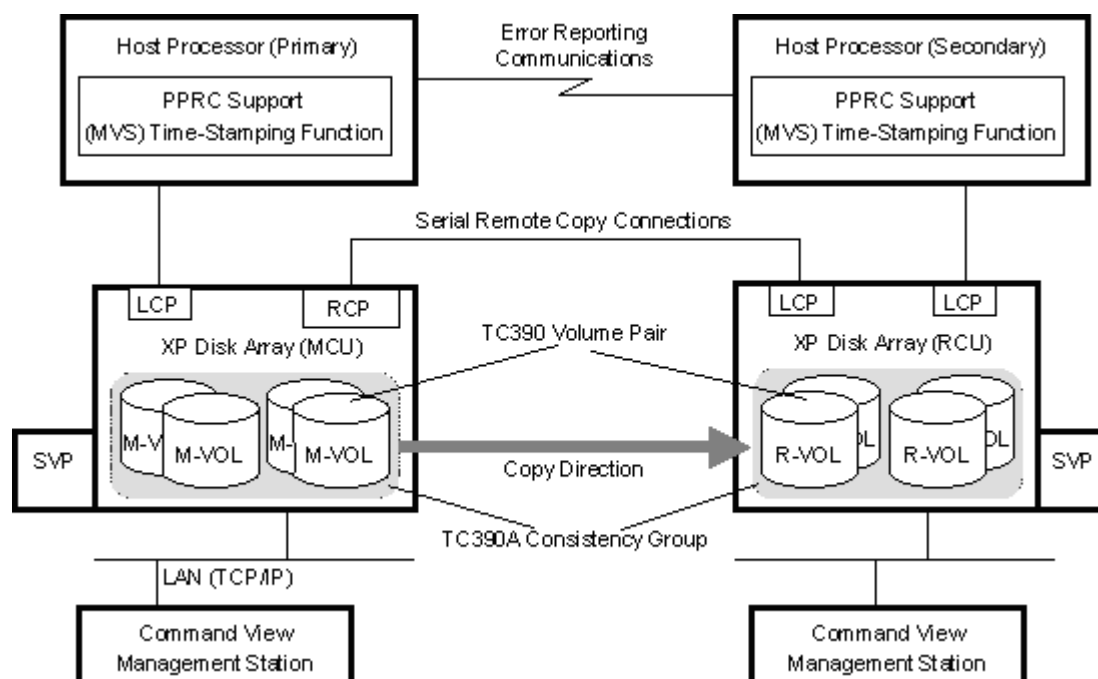


Figure 2 TrueCopy components for Fibre Channel connection

XP128/XP1024/XP12000

TC390 operations involve the main (primary) disk arrays and the remote (secondary) disk arrays. This chapter covers TC390 operations in which the main disk array is an XP128/XP1024/XP12000 and the remote disk array is either an XP128/XP1024/XP12000 or other XP disk arrays. The main disk arrays contain the TC390 main volumes (M-VOLs), which contain the original data and are online to the host(s). The remote disk arrays contain the TC390 secondary volumes (R-VOLs), which are the synchronous or

asynchronous copies of the M-VOLs. TC390 supports all CU images and logical volumes of the XP128/XP1024/XP12000. All XP128/XP1024/XP12000 with TC390 installed are compatible with the IBM PPRC host software function. For more information on PPRC, see ["Using PPRC Commands for TrueCopy"](#) on page 160. TC390 also supports all physical hard disk drive options and RAID5/RAID1 configurations for the XP128/XP1024/XP12000.

To provide greater flexibility and to enable the XP128/XP1024/XP12000 to be tailored to unique customer operating requirements, additional operational parameters, or optional modes, are available for the XP128/XP1024/XP12000. At installation, the XP128/XP1024/XP12000 modes are set to their default values so HP recommends that you discuss these settings with your HP representative. Only your HP representative can change the XP128/XP1024/XP12000 modes. [Table 3](#) shows the XP128/XP1024/XP12000 modes related to TC390 and PPRC (and HXRC) operations.



NOTE: This mode information was current at the time of publication of this document, but it may change. Contact your HP account support representative for the latest XP128/XP1024/XP12000 SVP mode information.

XP128/XP1024/XP12000 performing TC390A operations (main and remote) use sidefiles in cache for storing the TC390A recordsets. HXRC also uses cache sidefiles. Disk arrays performing TC390A and/or HXRC must have sufficient cache installed to handle the increased sidefile usage. Insufficient cache can degrade disk array I/O performance and cause command retry requests and state-change-pending (SCP) messages. For more information on cache usage and sidefile thresholds, see ["Inflow Control of Recordsets"](#) on page 40.

Table 3 XP128/XP1024/XP12000 modes for TrueCopy (and HXRC)

Mode	Description
20	Enables TC390 – R-VOL read-only function (RCU only).
21	Required ON for MCUs and RCUs that connect to channel extenders.
36	TC390 Synchronous – Selects function of CRIT=Y(ALL) or CRIT=Y(PATHS). Mode 36 ON: CRIT=Y(ALL) => equivalent to Fence Level = Data. Mode 36 OFF: CRIT=Y(PATHS) => equivalent to Fence Level = Status.
38	TC390 – Changes SSB reported against the WRITE I/O to the M-VOL in critical state. Mode 38 ON: Intervention required. Mode 38 OFF: Command rejected (PPRC specification).
45	HXRC – Sleep Wait suppressing option (see modes 61, 85, 86, 97; see "HXRC Device Blocking and Load Balancing" on page 225). When Mode 45 is ON and Mode 61 is ON, WRITE I/Os for LDEVs are blocked by the threshold specified by SDM. Mode 45 OFF: Sidefile threshold activates Sleep Wait timer at the sleep wait threshold. Mode 45 ON: Sidefile threshold does not activate Sleep Wait timer at the sleep wait threshold.
61	HXRC – Enables the DONOTBLOCK option of the XADDPAIR command (see mode 45; see "HXRC Device Blocking and Load Balancing" on page 225). Must be OFF if the operating system does not support the DONOTBLOCK option. Mode 61 OFF: DONOTBLOCK option ignored. Mode 61 ON: DONOTBLOCK option activated.

Table 3 XP128/XP1024/XP12000 modes for TrueCopy (and HXRC) (continued)

Mode	Description																		
64	<p>TC390 CGROUP – Defines scope of CGROUP command within the XP128/XP1024/XP12000. Must be OFF for GDPS.</p> <p>Mode 64 OFF: TC390 volumes behind the specified LCU pair (main and remote LCUs).</p> <p>Mode 64 ON: All TC390 volumes in this XP128/XP1024/XP12000.</p>																		
85, 86	<p>HXRC – Variable sidefile threshold (see modes 45, 97, 98; see "HXRC Device Blocking and Load Balancing" on page 225).</p> <p>Mode 85 ON and Mode 86 OFF: Thresholds for Sleep wait/SCP/Puncture = 30/40/50%</p> <p>Modes 85 and 86 OFF: Thresholds for Sleep wait/SCP/Puncture = 40/50/60%</p> <p>Mode 85 OFF and Mode 86 ON: Thresholds for Sleep wait/SCP/Puncture = 50/60/70%</p> <p>Modes 85 and 86 ON: Thresholds for Sleep wait/SCP/Puncture = 60/70/80%</p>																		
93	<p>Graduated delay process for sidefile control (see "Graduated Delay Sidefile Management" on page 42):</p> <p>Mode 93 OFF (default) = strong delay type</p> <p>Mode 93 ON = soft delay type</p> <table><tr><th><u>Amount of sidefile</u></th><th><u>Strong delay type</u></th><th><u>Soft delay type</u></th></tr><tr><td>threshold – [15-20%] (HWM)</td><td>100 ms x 1 time</td><td>20 ms x 1 time</td></tr><tr><td>threshold – [10-15%]</td><td>200 ms x 1 time</td><td>40 ms x 1 time</td></tr><tr><td>threshold – [5-10%]</td><td>300 ms x 1 time</td><td>60 ms x 1 time</td></tr><tr><td>threshold – [0-5%]</td><td>400 ms x 1 time</td><td>80 ms x 1 time</td></tr><tr><td>threshold or higher</td><td>500 ms x permanent</td><td>100 ms x permanent</td></tr></table>	<u>Amount of sidefile</u>	<u>Strong delay type</u>	<u>Soft delay type</u>	threshold – [15-20%] (HWM)	100 ms x 1 time	20 ms x 1 time	threshold – [10-15%]	200 ms x 1 time	40 ms x 1 time	threshold – [5-10%]	300 ms x 1 time	60 ms x 1 time	threshold – [0-5%]	400 ms x 1 time	80 ms x 1 time	threshold or higher	500 ms x permanent	100 ms x permanent
<u>Amount of sidefile</u>	<u>Strong delay type</u>	<u>Soft delay type</u>																	
threshold – [15-20%] (HWM)	100 ms x 1 time	20 ms x 1 time																	
threshold – [10-15%]	200 ms x 1 time	40 ms x 1 time																	
threshold – [5-10%]	300 ms x 1 time	60 ms x 1 time																	
threshold – [0-5%]	400 ms x 1 time	80 ms x 1 time																	
threshold or higher	500 ms x permanent	100 ms x permanent																	
97	<p>HXRC – Variable Sleep Wait timer duration (see modes 45, 85, 86; see "HXRC Device Blocking and Load Balancing" on page 225).</p> <p>Mode 97 OFF: Sleep Wait timer duration = 100 ms.</p> <p>Mode 97 ON: Sleep Wait timer duration = 10 ms.</p>																		
98	<p>HXRC – Selects SCP or session cancel (see modes 45, 85, 86; see "HXRC Device Blocking and Load Balancing" on page 225).</p> <p>Mode 98 OFF: SCP.</p> <p>Mode 98 ON: Forced session cancel.</p>																		
104	<p>TC390 CGROUP – Selects disk array default for CGROUP FREEZE option. Applies to 3990 emulation only.</p> <p>Mode 104 is invalid if the controller emulation is 2105. For 2105, use the CGROUP option of CESTPATH.</p> <p>Mode 104 ON: FREEZE enabled.</p> <p>Mode 104 OFF (default): FREEZE disabled.</p>																		

Table 3 XP128/XP1024/XP12000 modes for TrueCopy (and HXRC) (continued)

Mode	Description
114	<p>TC390 – Allows dynamic port mode setting (RCP/LCP for serial, Initiator/RCU target for Fibre Channel) through PPRC CESTPATH and CDELPATH commands.</p> <p>Mode 114 ON: Set defined port to RCP/LCP mode (serial) or Initiator/RCU target mode (Fibre Channel) as needed.</p> <p>Mode 114 OFF (default): Port must be reconfigured using Command View management station.</p> <p>For Fibre Channel interface, do not use the CESTPATH and CDELPATH commands at the same time as the SCSI path definition function of LUN Management. The Fibre Channel interface ports need to be configured as initiator ports or RCU target ports <i>before</i> the CESTPATH and CDELPATH commands are issued.</p> <p>Before issuing the CESTPATH command, verify that the relevant paths are offline from the host(s) (for example, configure the Chipid offline, deactivate the LPAR, or block the port in the ESCD). If any active logical paths still exist, the add path operation will fail because the port mode (LCP/RCP) cannot be changed.</p>
118	<p>HXRC and TC390A – SIM notification when:</p> <p>HXRC sidefile reaches sleep wait threshold.</p> <p>TC390A sidefile reaches high-water mark (HWM = sidefile threshold - 20%) (see mode 93).</p> <p>Mode 118 ON: Generate SIM.</p> <p>Mode 118 OFF (default): No SIM generated.</p>

Control Units (MCUs and RCUs)

The main control unit (MCU) and remote control unit (RCU) control the following TC390 operations:

- The MCU is the control unit (CU) in the main disk array that controls the M-VOLs of the TC390 volume pairs. The Command View management station must be LAN-attached to the MCU of each TC390 pair. The MCU communicates with the RCU through the dedicated ESCON or Fibre Channel remote copy connections. The MCU controls the host I/O operations to the TC390 M-VOLs as well as the TC390 initial copy and remote copy operations between the M-VOLs and R-VOLs. The MCU also manages the TC390 pair status and configuration information.
- The RCU is the CU in the remote disk array that controls the R-VOLs of the TC390 volume pairs. The RCU assists in managing the TC390 pair status and configuration (for example, rejects write I/Os to TC390 R-VOLs). The RCU executes the remote copy operations issued by the MCU. The secondary Command View management station should be LAN-attached to the RCUs at the remote site. The RCUs should also be attached to a host system to allow sense information to be reported in case of a problem with a secondary volume or remote disk array and to provide disaster recovery capabilities.

The MCU and RCU can be defined separately for each TC390 pair. The XP128/XP1024/XP12000 CU can function simultaneously as an MCU for one or more M-VOLs and as an RCU for one or more R-VOLs, provided the remote copy connections and ports are properly configured. The XP128/XP1024/XP12000 CU provides up to 32 logical CU images. TC390 operations can be performed on all logical devices (LDEVs) in all logical CU images. You can use TC390 to select a CU image in the connected MCU and specify a CU image in the RCU.



CAUTION: If you are connecting the XP128/XP1024/XP12000 and other XP disk arrays in a mixed configuration, verify that each disk array has a unique serial number. Although this would be extremely rare, it is possible that a serial number overlap could occur. If you have two disk arrays with the same serial number and you need to configure remote copy pairs between the two disk arrays, contact your HP account support representative for assistance.

CU Emulation Types

TC390 supports 3990-3, 3990-6, 3990-6E, and 2105 controller emulation types for the MCU and RCU. The emulation type of the MCU and RCU can be different. The 3990-6, 3990-6E, or 2105 emulation is required for SMS I/O time-stamping of TC390A recordsets. The 2105 emulation type is required for HPAV operations.

Changing from 3990 to 2105: If you need to change the emulation from 3990 to 2105 for an XP128/XP1024/XP12000 that has existing HXRC pairs, you must:

1. Stop all jobs and delete all HXRC pairs.
2. Change the CU emulation type of all CHA packages in the XP128/XP1024/XP12000 to 2105. Do not intermix 3990 and 2105 emulations in the same disk array.
3. Restart jobs and re-establish HXRC pairs.



NOTE: The PPRC commands are different for 3990 and 2105 emulation types. For more information on using PPRC TSO commands with 2105 emulation, refer to ["Using PPRC Commands for TrueCopy"](#) on page 160.



NOTE: For important information on GDPS support and 2105 emulation, see ["GDPS Support"](#) on page 52.

Volume Pairs (M-VOLs and R-VOLs)

TC390 performs remote copy operations for logical volume pairs established by the user. Each TC390 pair consists of one main volume (M-VOL) and one remote volume (R-VOL), which are located in different disk arrays. The TC390 M-VOLs are the primary volumes that contain the original data, and the TC390 R-VOLs are the secondary or mirrored volumes that contain the backup or duplicate data. The main and remote volumes must have the same format and capacity.

During normal TC390 operations, the TC390 M-VOL remains available to all hosts at all times for read and write I/O operations. The RCU rejects all I/Os to a TC390 R-VOL. The R-VOL read option (see ["R-VOL Read Option"](#) on page 37) allows read-only access to a TC390 R-VOL while the pair is suspended.

TC390 supports a maximum of 8192 pairs. TC390 supports the basic logical volume images (LVIs) available on the XP128/XP1024/XP12000, such as 3390-3, 3390-3R, 3390-9, and 3390-L. For information on LVI requirements and support, see ["Logical Volume Image \(LVI\)"](#) on page 56.



CAUTION: Do not use M-VOLs or R-VOLs from hosts that have different CU emulation types (2105 and 3990) at the same time. If you use the M-VOLs or R-VOLs from the 2105 and 3990 hosts simultaneously, an MIH message might be reported to the 3990 host.

Remote Copy Connections

The remote copy connections are the physical paths used by the TC390 MCUs to communicate with the TC390 RCUs. The maximum number of physical paths per logical CU image is eight for Fibre Channel, eight for serial with 2105 emulation, and four for serial with 3990 emulation. The MCUs and RCUs are connected through the serial interface (ESCON) or Fibre Channel interface cables.

When serial interface connections are used, ESCON directors (ESCDs) and/or ESCON repeaters are required for distances greater than 3 km (1.9 miles). TC390 operations can be performed at distances of up to 43 km (26.7 miles) using standard ESCON support. When using Fibre Channel interface (multimode shortwave) connections, two switches are required for distances greater than 0.5 km (1,640 feet). Distances up to 1.5 km (4,920 feet, 0.93 miles) are supported.

When using Fibre Channel interface (single-mode longwave) connections, two switches are required for distances greater than 10 km (6.2 miles). Distances up to 30 km (18.6 miles) are supported. Long-distance solutions are provided, based on user requirements and workload characteristics, using approved channel extenders and communication lines (for example, T1/T3/ATM).

The MCU-to-RCU remote copy configuration for TC390A has different requirements than the TC390 Synchronous configuration:

- TC390 Synchronous supports 1-to-n and n-to-1 remote copy connections ($n \leq 4$). One MCU can be connected to as many as four RCUs, and one RCU can be connected to as many as four MCUs (one MCU/RCU = one physical CU, including all CU images). TC390 supports the dynamic switching capability of the ESCDs that is used to share the physical interface cables between the components. The ESCDs can accommodate channel-to-MCU and channel-to-RCU connections in addition to the remote copy connections.
 - TC390A supports 1-to-1 remote copy connections within the same consistency group. The M-VOLs and R-VOLs of the pairs in a consistency group must be located within one physical MCU and one physical RCU. This configuration ensures backup integrity for data which is spread across multiple volumes within one disk array.
- CA 1-to-n and n-to-1 configurations are valid for TC390A, as long as each consistency group does not span local or remote disk arrays.
- Fibre remote copy supports 1-to-1 remote copy connections. One disk array as an MCU can be connected to only one disk array as an RCU via optical fibre cables. For the CU images within one disk array, 1-to-4 and 4-to-1 remote copy connections are supported.



NOTE: HP strongly recommends that you establish at least two independent remote copy connections (one per cluster) between each MCU and RCU to provide hardware redundancy for this critical communications path.

For disk arrays with both TC390 and FICON host attachment, you must set the path configuration carefully. The following table lists the possible path configurations and indicates which combinations are supported.

Table 4 TC390 configuration with FICON

Application Site Path (System - DKC)	MCU-RCU	For Use
ESCON	ESCON	Supported
ESCON	Fibre Channel	Supported
FICON	ESCON	Not Support ¹
FICON	Fibre Channel	Supported

1. The configuration of FICON for channel-MCU paths and ESCON for MCU-RCU paths is not supported, because the bandwidth of FICON is greater than that of ESCON interface. If FICON is used for channel-MCU paths, use fibre-channel interface for the MCU-RCU paths.

Initiator Ports and RCU Target Ports

The initiator ports are the dedicated Fibre Channel interface ports on the main disk array (MCU) to which the RCUs (RCU target ports) are connected. The initiator ports connect to the RCUs to send write I/O operations directly to the RCUs. Any Fibre Channel interface port of the XP128/XP1024/XP12000 can be configured as an initiator port. Use the Port Change window to change the configuration of the XP128/XP1024/XP12000 Fibre Channel ports (ordinary target port, initiator port, or RCU target port) as needed.

The RCU target ports are the dedicated Fibre Channel interface ports on the remote subsystem (RCU) to which the MCU (initiator ports) are connected. Any Fibre Channel interface port of the XP128/XP1024/XP12000 can be configured as an RCU target port. The RCU target ports can be connected to the host channel paths via the Fibre Channel switch.

To fully support an automated environment, the XP128/XP1024/XP12000 is capable of automatically configuring a Fibre Channel port as an Initiator or RCU target if required in response to the TSO CESTPATH and CDELPATH commands. See the SVP mode 114 in [Table 3](#) on page 28.



NOTE: For Fibre Channel interface, do not use the CESTPATH and CDELPATH commands at the same time as the SCSI path definition function of LUN Management.

Two or more initiator ports must be configured before you can add the RCUs and create the TC390 volume pairs. The initiator ports cannot communicate with the host processor channels. To enable the host processor channels to send write I/O operations to the MCU, the host channel paths must be connected to the other Fibre Channel interface ports in the MCU. Ordinary Fibre Channel interface ports cannot be connected to the MCU. These ports (usually called target ports) can be connected to the host processor channels only.

Remote Control Ports (RCPs) and Local Control Ports (LCPs)

The remote control ports (RCPs) are the dedicated serial interface ports on the main disk subsystem (MCU) to which the RCUs are connected. The RCPs emulate host processor channels to enable the MCUs to send write I/O operations directly to the RCUs. The RCPs support the dynamic switching capability provided by the ESCDs. Any serial port of the XP128/XP1024/XP12000 can be configured as an RCP. You can use TC390 to change the configuration of the disk array serial ports (LCP or RCP) as needed.

The local control ports (LCPs) are used for connecting with the host processor channel interface. All serial interface ports on the XP128/XP1024/XP12000 have a default setting of LCP. An RCU port connected to an MCU must be in LCP mode to receive remote copy I/O operations from the MCU.

To fully support an automated environment, the XP128/XP1024/XP12000 is capable of automatically configuring a serial port as an RCP or LCP if required in response to the TSO CESTPATH and CDELPATH commands. See the SVP mode 114 in [Table 3](#) on page 28.



CAUTION: Before issuing the CESTPATH command, verify that the relevant paths are offline from the host(s) (for example, configure the Chipid offline, deactivate the LPAR, or block the port in the ESCD). If any active logical paths still exist, the add path operation will fail because the port mode (LCP/RCP) cannot be changed.

Two or more RCPs must be configured before you can add the RCUs and establish the TC390 volume pairs. The RCPs cannot communicate with the host processor channels and are dedicated to TC390 operations. The host channel interface paths must be connected to the other serial interface ports on the disk array.

Also, the serial interface ports, 1S-1Z and 2S-2Z, cannot be specified as RCPs.

The CHA package port that is added to DKA slot cannot be specified as RCPs. Therefore, if you specify this port number to use TSO CESTPATH command, an error will occur.

Command View Management Station

The Command View management station communicates with the each attached XP128/XP1024/XP12000. The SVP at the main site must be connected to the MCU of each TC390 volume pair. A second SVP should also be installed at the remote site and connected to the RCUs. With another SVP at the remote site, you can modify the async options of the RCU (pending update data rate, offloading timer) and access the TC390 R-VOLs (for example, to perform ICKDSF). If you need to perform TC390 operations in the reverse direction from the remote site to the main site (for example, disaster recovery), using TC390 through Command View simplifies and expedites this process.

If you plan to perform TC390A operations, you must use the TC390 software to add the consistency groups and select group options and async options before you can add any TC390A pairs. These functions can be performed only using TC390 through Command View. After the consistency groups and asynchronous options have been configured, the PPRC TSO commands can be used to establish and manage TC390A pairs.



NOTE: For information on TC390A configuration services, contact your HP account support representative.

Asynchronous Consistency Groups

A TC390A consistency group is a user-defined set of volume pairs across which update sequence consistency is maintained and ensured at the remote site. Each TC390A volume pair must be assigned to a consistency group. You can use TC390A to configure up to 128 consistency groups (0-7F) for each MCU and provides group-based operations for consistency groups (for example, suspend and resume group). You can use consistency groups to maintain update sequence consistency for databases that span multiple volumes, allowing immediate database recovery at the remote site when needed. For more information on TC390A consistency group operations, see ["TrueCopy Asynchronous Consistency Group Operations"](#) on page 44.

Host I/O Time-Stamping Function

If you plan to establish TC390A consistency groups, the I/O time-stamping function must be installed on the host processor at the main (primary) site. The I/O time-stamp, which is provided by MVS DFSMSdfp, is the same time-stamp that is used by IBM XRC pairs. The RCU requires the I/O time-stamp information to process TC390A recordsets. The I/O time-stamping function should also be installed on the host processor at the remote (secondary) site so that time-stamps can be used when copying data in the reverse direction.



NOTE: If the main and/or remote system consists of several CPU complexes, a SYSPLEX timer is required to provide a common time reference for the I/O time-stamping function.

Error Reporting Communications

Error reporting communications (ERC), which transfers information between host processors at the main and remote sites, is a critical component of any disaster recovery effort. You can configure ERC using channel-to-channel communications, NetView technology, or other interconnect technologies, depending on your installation requirements and standards. Neither TC390 nor Command View provides ERC between the main and remote sites.

When TC390 is used as a data migration tool, ERC is recommended but is not required. When TC390 is used as a disaster recovery tool, ERC is required to ensure effective disaster recovery operations. When a TC390 pair is suspended due to an error condition, the MCU generates sense information, which results in an IEA491E system console message. This information should be transferred to the remote site through ERC for effective disaster detection and recovery.

Remote Copy Operations

The following figure illustrates the two types of TC390 remote copy operations: initial copy and update copy. To reduce the overhead associated with these remote copy activities and maximize data transfer, the XP128/XP1024/XP12000 uses a special write command that is allowed only for TC390 initial and update copy operations. This command transfers the control parameters and the FBA-format data for consecutive updated records in a track using a single write operation. The special TC390 write command reduces interlocks on the ESCON interface protocol as well as the overhead required for performing FBA-to-CKD and CKD-to-FBA conversions.

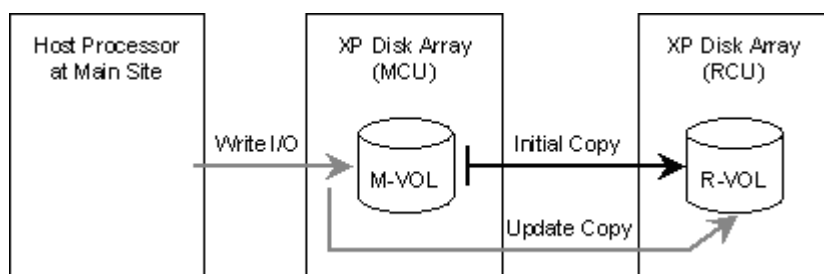


Figure 3 TrueCopy remote copy operations

Initial Copy Operations

The initial copy operation synchronizes the M-VOL and R-VOL independently of host I/O processes. The initial copy operation is the same for TC390 Synchronous and TC390A pairs. A TC390 initial copy operation takes place when you add a new pair or resume a suspended pair. When a new pair is established, the entire contents of the M-VOL are copied to the R-VOL cylinder by cylinder, including the VTOC (volume table of contents) but not including the diagnostic and unassigned alternate tracks. For new pairs, you can also select **No Copy** or **None** for the initial copy mode, which copies only the VOLSER (volume serial number) to the R-VOL. If **No Copy** or **None** is selected, the user is responsible for ensuring that the M-VOL and R-VOL are already identical. The MCU cannot verify the contents of the volumes. When a suspended pair is resumed (also called a resync operation), only the VOLSER and out-of-sync cylinders (updated by write I/Os while the pair was suspended) are copied to the R-VOL.

For additional flexibility, TC390 provides the following options for the initial copy operation:

- Use the **number of tracks** option to specify how many tracks are copied simultaneously by the TC390 initial copy operation when adding/resuming a TC390 pair. This option can be specified using TC390 through Command View (Add Pair-Option) and the CESTPAIR TSO command (PACE parameter).

- Use the **Initial Copy Parameters: Priority** option to specify the order in which the initial copy operations are performed when adding/resuming multiple TC390 pairs. This option can only be specified using TC390 through Command View (Add Pair).
- Use the **Maximum Initial Copy Activities** option to specify the maximum number of concurrent initial copy operations that each MCU can perform (not pair-specific). This option can only be specified using TC390 through Command View (RCU Option window).

Update Copy Operations

A TC390 update copy operation occurs when the host issues a write I/O operation to the M-VOL of a TC390 pair. The update copy operation duplicates the M-VOL write I/O at the R-VOL to keep the M-VOL and R-VOL synchronized. TC390 provides two modes for update copy operations: synchronous and asynchronous. The update copy mode is specified when you add a TC390 pair and cannot be changed. TC390 can also specify whether the cache-fast-write (CFW) data is included in the update copy operations.

For synchronous update copy mode, the MCU ensures that the M-VOL and R-VOL are synchronized at all times. The MCU does not return device-end status for the M-VOL write I/O until both the M-VOL write and its associated update copy operation at the RCU are complete. For synchronous mode, the MCU starts the update copy operation when it receives one of the following:

- The last write command in the current domain, specified by the preceding locate record command.
- A write command that requires switching to the next track.
- A write command that was not preceded by a locate record command.



NOTE: If many consecutive records are updated by a single CCW chain that does not use the locate record command (for example, long sequential chained write operations), disk array performance may be significantly impacted.

For asynchronous update copy mode, the MCU stores the M-VOL updates along with additional control information in cache, and sends the updates and control information to the RCU completely independent of the host I/O processes. These updates with their associated control information are called TC390A recordsets. The RCU stores the TC390A recordsets in cache and performs the updates to the R-VOLs in the same order as they were performed at the MCU(s) according to the TC390A time-stamp and sequence information. For more information on TC390A recordset operations, see ["TrueCopy Asynchronous Recordset Operations"](#) on page 38.

Priority of initial and update copy: In both TC390 Synchronous and TC390A, update copy has higher priority than initial copy. However, initial copy is executed based on the copy pace (3 or 15 tracks), therefore, update copy must wait this interval if initial copy is being executed. For example, if the copy pace is 15 tracks, the update copy may wait up to 15 tracks (1 cylinder). In the case of TC390A, update copy is executed asynchronously, but the same scheduling conflict can occur between the asynchronous update copy (write recordset) and initial copy.

Read and Write I/O Operations for TrueCopy Volumes

When an MCU receives a read command for a TC390 M-VOL, the MCU completes the read from either cache or the M-VOL. If the read fails, the redundancy provided by RAID technology recovers the failure. The MCU does not read the TC390 R-VOL for recovery.

When an MCU receives a write command for a TC390 Synchronous M-VOL with *pending duplex* status (and the track has already been copied to the R-VOL), the MCU performs a synchronous update copy operation to complete the write at the R-VOL. When an MCU receives a write command for a *pending duplex* TC390A M-VOL (and the track has already been copied to the R-VOL), the MCU performs an asynchronous update copy operation.

When an MCU receives a write command for an M-VOL with *duplex* status, the user-selected update copy mode of the pair (synchronous or asynchronous) determines the sequence of events:

- **Synchronous Mode:** The MCU performs the write operation on the M-VOL, reports channel-end status to the host, starts the update copy operation for the R-VOL, and then reports device-end status to the host only after the update copy operation is complete. If the M-VOL write or R-VOL update copy operation fails, the MCU reports a unit check, and the host system and application program will regard that write operation to the M-VOL as failed. If a failure occurs at the M-VOL or the R-VOL, the corresponding volume of the TC390 pair will decommit the update to maintain exact synchronization of the volumes.
- **Asynchronous Mode:** The MCU completes M-VOL write operations independently of the associated update copy operations at the R-VOL. The RCU manages the R-VOL updates according to the TC390A recordset information and maintains time-based data consistency for the R-VOLs. If the M-VOL write operation fails, the MCU reports a unit check and does not create the TC390A recordset for this operation. If the update copy operation fails, the RCU suspends either the affected pair or all TC390A pairs in the consistency group, depending on the type of failure. When the suspended TC390A pair or group is resumed, the MCU and RCU negotiate the resynchronization of the pair(s). For more information on suspended TC390A pairs, see ["Suspended TrueCopy Asynchronous Pairs"](#) on page 50.

The RCU does not allow a TC390 R-VOL to be online and rejects all host-requested read and write I/O operations for a TC390 R-VOL. The TC390 R-VOLs must be offline during normal TC390 operations. TC390 provides a special R-VOL read option that allows read-only access to the R-VOL while the pair is suspended (see ["R-VOL Read Option"](#) on page 37 for information on the R-VOL read option). If you need write access to a TC390 R-VOL, you must delete the pair.

R-VOL Read Option

For additional flexibility, TC390 offers a special R-VOL read option. The HP representative enables the R-VOL read option on the RCU (mode 20). You can use the TC390 R-VOL read option to read a TC390 R-VOL only while the pair is suspended, without having to delete the pair. The RCU will change only the VOLSER of the suspended R-VOL so that the R-VOL can be online to the same host as the M-VOL while the pair is suspended. **All other write I/Os will be rejected by the RCU.** The MCU copies the M-VOL VOLSER back onto the R-VOL when the pair is resumed. When the R-VOL read option is not enabled and/or the pair is not suspended, the RCU rejects all read and write I/Os to a TC390 R-VOL. If you need write access to an R-VOL, you must delete the pair.



NOTE: For 2105 controller emulation, the CSUSPEND command to the R-VOL of a suspended TC390 pair will be rejected when the TC390 R-VOL read option is used.

Difference Management

The differential data (updated by write I/Os during split or suspension) between M-VOL and R-VOL is stored in each cylinder bitmap. When a deleted/suspended pair is resumed (Resume Pair), the MCU merges the M-VOL and R-VOL bitmaps, and the differential data is copied to the R-VOL. The unit of data

stored in the bitmap is Track or Cylinder. When adding a pair (Add Pair), you can select Track or Cylinder and you can also confirm the unit.

Table 5 Operation of the unit of data stored in bitmap

Program	The Unit of Data Stored in Bitmap			Confirmation
	Default (Auto) ¹	Track	Cylinder	
Command View	Available	Available	Available	Available
PPRC TSO	Not available	Not available	Not available	Not available

1. Default (Auto) means that Track or Cylinder is automatically set according to the capacity (number of cylinders or number of cylinders set by VLL) of the volumes used for the pairs. For volumes that have 10,019 cylinders or more, Cylinder is set. For other volumes, Track is set.

When you add a pair with the setting of Track, the number of pairs you can create is restricted. If you create the pairs more than the restricted number, a pair is automatically added with Cylinder. You can restrict the automatic change of the setting. Before using this function, contact your HP account support representative.

The restriction of the number of pairs depends on the capacity of the volumes used for the pairs. Both of the MCU and RCU are restricted.

The number of bitmap area in the disk array is 10,476. You can calculate the number of bitmap area. If the calculated bitmap area exceeds the number of bitmap area in the disk array, adding pairs operation is restricted.

To calculate the number of bitmap area, you can use the following equation:

$$((\lceil (\text{Number of Cylinders} * 15) / 75,136 \rceil) - 1)$$

Table 6 Maximum number of pairs possible for the basic LU type

Basic Logical Unit (LU) Type	Number of Cylinders	Maximum Number of Pairs
3390-3/3A/3B/3C	3,339	8,192
3390-9	10,017	8,192
3390-L	32,760	1,746

TrueCopy Asynchronous Recordset Operations

The TC390A recordsets contain the TC390A M-VOL updates and the associated control information, including the time-stamp of the M-VOL update, which enables the RCU to maintain update consistency of the TC390A R-VOLs. TC390A recordset operations include:

- Creating and storing recordsets at the MCU
- Sending recordsets to the RCU
- Storing recordsets at the RCU
- Selecting and settling recordsets at the RCU
- Types of recordsets
- Inflow control for sidefiles

- Dummy pair mode

Creating and Storing Recordsets at the MCU

When an MCU performs an update (host-requested write I/O) on a TC390A M-VOL, the MCU creates a TC390A recordset that contains: the updated record, time-stamp information, sequence number, record location (device, cylinder, track, record number), and record length. The TC390A recordsets are queued in the cache storage of the MCU and sent to the RCU independent of host I/O processes. The RCU uses the time-stamp and sequence number information in the recordsets to update the R-VOL(s) in the same order as the M-VOL(s).

The time-stamp information is acquired from the (MVS) host's I/O time-stamp function. This time stamp provides a protective measure for write-dependent applications and minimizes recovery time in the event of a disaster. The sequence number indicates the number of recordsets that the MCU has created for each consistency group. The recordset information, except for the updated records, is stored and queued in an area of cache known as sidefile cache. For more information on sidefile cache, see ["Inflow Control of Recordsets"](#) on page 40.

Sending Recordsets to the RCU

The MCU sends the TC390A recordsets to the RCU in a similar manner to the TC390 Synchronous updates. The MCU's RCPs and/or initiator ports act as host processor channels and issue special I/O operations, called remote I/Os (RIOs), to the RCU. The RIO transfers the recordsets in FBA format (not CKD) using a single channel command, eliminating the overhead associated with FBA-CKD conversion and thus providing more efficient transfer of user data. The MCU can send several recordsets using a single RIO, even if their sequence numbers are not contiguous. Therefore, TC390A recordsets are usually sent to the RCU in a different order than the arrivals at the MCU. The RCU ensures that records are applied to the R-VOLs in the correct sequence. This method of remote I/O provides the most efficient use of MCU-to-RCU link resources.



NOTE: The parameter length and detailed specification of this TC390A channel command are different than for TC390 Synchronous RIOs. Verify that your channel extenders are capable of supporting this command. For further details, contact your HP account support representative.

Storing Recordsets at the RCU

The RCU maintains queues to control the storing of recordsets in the sidefile and commitment of updating records in the R-VOLs. The RCU queuing mechanism uses time-stamping to control the sequence in which R-VOL updates are applied and uses sequence numbers provided by the MCU to check for any missing updates.



NOTE: The MCU does not remove the sidefile entry for a recordset from its cache until it receives an I/O completion signal (device end) from the RCU. This is true even if the MCU and RCU are connected through a channel extender product. If a recordset is lost in transmission from the MCU to the RCU, the MCU's cylinder bitmap ensures that the missing recordset is identified and resent to the RCU.

Selecting and Settling Recordsets at the RCU

The RCU selects the recordset to be promoted to formal data (or "settled") as follows:

1. The RCU checks for a valid entry at the top of each queue in the consistency group. If the top of any queue is empty (for example, recordset not yet received), the RCU waits for that entry.
2. When the top of each queue contains a valid entry (recordset), the RCU selects the entry that has the earliest time-stamp value, and then settles this recordset.

3. The RCU repeats this process to select and settle TC390A recordsets.

The following figure illustrates recordset selection and settling at the RCU. In this example, the top of the queue contains a valid entry: S1/T1. The RCU selects recordset S1/T1 to be settled because T1 is the earliest time-stamp. When S1/T1 is removed from the MCU queue, recordset S2 becomes the top entry, but it is empty. When recordset S2 arrives (and its time-stamp is later than T1 and earlier than T3), the RCU selects S2/T2 as the next recordset to be settled. The recordset selected by the RCU is marked as “host-dirty” and treated as formal data. The time-stamp value of that recordset is promoted to the consistency time (C/T) of the group. The RCU settles the updated records in the recordset as follows:

- If the corresponding track is in cache (track-hit), the updated records in the recordset are copied to the existing cached track and the cache space for the sidefile is released.
- If the corresponding track is not in cache (track-miss), the RCU changes the cache designation of the sidefile to formal data. The data is not physically moved.

Types of Recordsets

In addition to host update recordsets, the MCU passes control information to the RCU in special non-update recordsets. These special recordsets indicate when volume pair status changes and when an MCU power-off sequence is initiated, and also maintain sequence numbers in periods of low host activities.

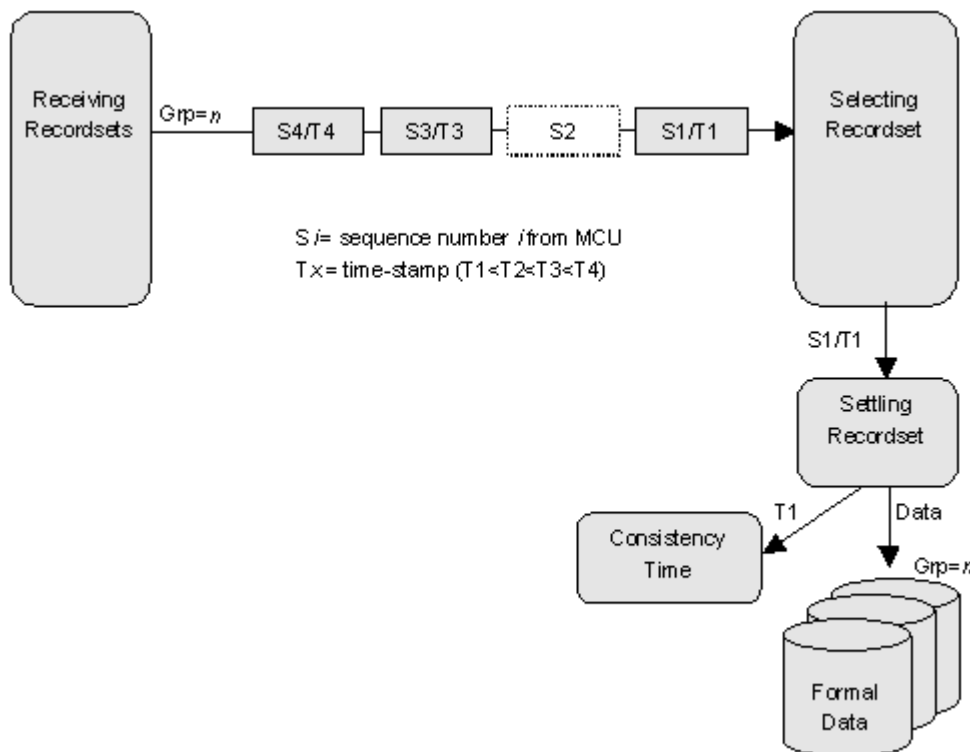


Figure 4 Selecting and settling TrueCopy Async recordsets at the RCU

Inflow Control of Recordsets

As described in the previous sections, both the MCU and RCU create sidefiles for storing TC390A recordsets. Because the sidefiles occupy exclusive space in cache, both the MCU and RCU perform inflow control to prevent an overload of the disk array's cache resources. The XP128/XP1024/XP12000 uses the following parameters (specified on the TC390 Async Option window, see “[Asynchronous Copy Option](#)” on page 112) for TC390A cache inflow control:

- **Sidefile Threshold** = maximum cache % available for use by TC390A sidefiles. [Table 7](#) on page 41 shows the TC390A sidefile threshold values and describes the actions that occur when each threshold is reached.

- The “high-water mark” (HWM), which is the sidefile threshold minus 20%, indicates when graduated delay begins for TC390A volume pairs (see the following section). If SVP mode 118 is ON, a warning SIM is also generated.
- The puncture threshold, which is the sidefile threshold plus 10%, indicates when the TC390A pairs will be suspended due to sidefile overflow (see “[CESTPATH](#)” on page 164).
- **Inflow control by MCU:** When the amount of MCU sidefile cache reaches the HWM, the MCU responds to update I/Os from the host with state-change-pending (SCP) or channel-command-retry requests and begins graduated delay.
- **Inflow control by RCU:** When the amount of RCU sidefile cache reaches the HWM, the RCU responds with channel-command-retry requests to the RIO commands, which transfer the recordsets from the MCU. The only recordset accepted by the RCU is the recordset with the sequence number required to continue settling pending recordsets.
- **Offloading Timer** = maximum time between TC390A recordset transfers.
 - **Inflow control by MCU:** If the MCU is not able to send a recordset to the RCU within the user-specified offloading timer value, the MCU suspends all TC390A pairs and resets the SCP condition to avoid hanging up the system.
 - **Inflow control by RCU:** If the RCU is not able to settle a recordset within the user-specified offloading timer value, the RCU suspends all TC390A volume pairs and resets the channel-command-retry condition to avoid hanging up the MCU.

HXRC. HXRC operations use a different cache sidefile than TC390A. [Table 7](#) on page 41 also shows the sidefile threshold values for HXRC operations and describes the actions that occur when each threshold is reached. Disk arrays performing TC390A in combination with HXRC must have sufficient cache installed to handle the increased sidefile activity. If a “sidefile puncture” condition occurs (HXRC sidefiles reach 10% over threshold), the XRC session having the highest sidefile usage is terminated.

SIM reporting for sidefile conditions is disabled when mode 118 is OFF ([Table 3](#) on page 28).



NOTE: Cache LUN XP operations may decrease the total amount of cache available for TC390A and HXRC operations, but do not directly affect sidefile cache usage. Available cache is defined as the amount of physical cache memory installed on the disk array minus any cache reserved for the Cache LUN XP feature.

Table 7 Sidefile thresholds

Operation	Threshold(s)	Action(s)
TC390A	High-water mark (HWM) = sidefile threshold – 20%	MCU (RCU) reaches HWM: command retry to host (MCU), begin graduated delay. Delay times can be adjusted using mode 93 (see Table 3 on page 28).
	Sidefile threshold = 30-70% of cache, default = 50%. TC390A threshold can be adjusted from 30-70% (in 10% increments) using TC390 through Command View.	MCU (RCU) reaches threshold: command retry to host (MCU), max delay time (500 or 100 ms). Delay time can be adjusted using mode 93 (see Table 3 on page 28).
	Puncture threshold = sidefile threshold + 10%	MCU (RCU) reaches puncture: suspend affected TC390A pairs due to sidefile overflow condition.

Table 7 Sidefile thresholds (continued)

Operation	Threshold(s)	Action(s)
HXRC ¹	<p>[XRC sidefile] / [avail cache] = 40%, 50%, 60%</p> <p>XRC thresholds can be adjusted by using modes 85 and 86 (see Table 3 on page 28).</p> <p>Threshold 1/2/3 = 30/40/50%, 40/50/60%, or 60/70/80%</p>	<p>Threshold 1 = command retry.</p> <p>Threshold 2 = SCP message.</p> <p>Threshold 3 = puncture condition.</p>
Write Pending	[write pending] / [avail cache - sidefile] = 70%	Command retry.

1. For more information on sidefile thresholds for HXRC operations, refer to "HXRC Device Blocking and Load Balancing" on page 225.

Graduated Delay Sidefile Management

The following figure shows the graduated delay process for TC390A sidefile management. When the TC390A sidefile value reaches the high-water mark (threshold minus 20%), the XP128/XP1024/XP12000 begins command retry delay for host updates to TC390A M-VOLs and reports a warning SIM to the host. As the amount of sidefile increases, the delay increases incrementally as shown in the following figure. Use Mode 93 on the XP128/XP1024/XP12000 SVP (refer to [Table 3](#) on page 28) to select the delay type (long or short). This graduated delay methodology minimizes the potential for sidefile overcommitment, while at the same time providing another level of automation control.

SIM reporting for TC390A sidefile conditions is enabled only when SVP mode 118 is ON (refer to [Table 3](#) on page 28).

You can disable the command retry delay for a limited number of critical volumes using the special "No delay" parameter for the CESTPAIR TSO command (see "CESTPAIR" on page 166). When this parameter is set, the XP128/XP1024/XP12000 will not delay host write I/Os to the M-VOL until the TC390A sidefile amount reaches the puncture threshold (threshold + 10%). This prevents performance degradation for critical volumes and should be used only for a small number of volumes.

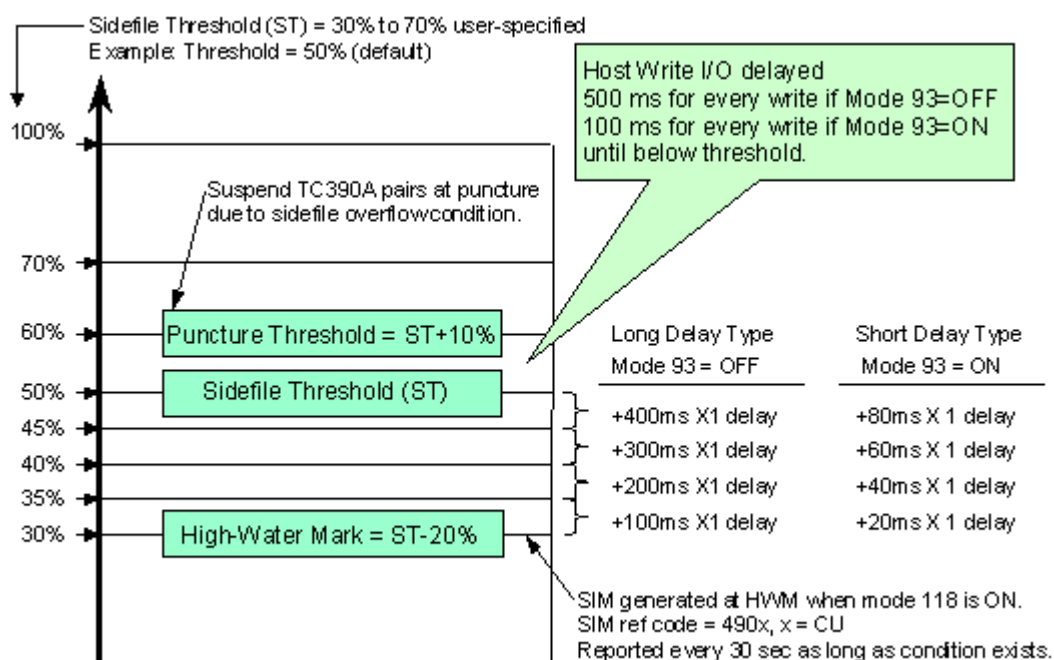


Figure 5 Graduated delay process for sidefile management

Dummy Pair Mode

TC390A performance can be limited due to RIO response through CNT/ATM. This is because only one RIO at a time can transfer updates to remote side. RIO is issued with the device address of secondary volume. ESCON protocol allows only one I/O at a time to the same device address. Dummy pair mode addresses this limitation by providing additional device addresses for specific high-usage volumes.

In the following figure, updates to the primary volume (A) are transferred to the device addresses of its secondary volume (A') as well as the secondary volumes of dummy volume pairs (B'-D') in parallel.

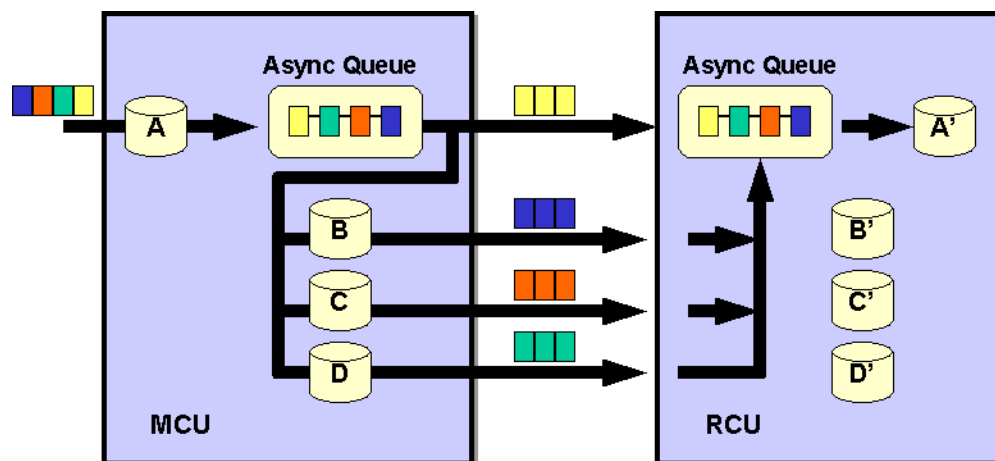


Figure 6 Dummy pair mode

The basic specifications for dummy pair mode are:

- Up to three dummy pairs can be related to one real volume pair.
- Volumes must be assigned in both the MCU and RCU for dummy pair.
- Custom-size volumes of minimum size (one cylinder) can be used for dummy pair.
- Dummy pair volumes cannot accept host I/Os, must be offline from all host systems.
- Volumes for a dummy pair must be in the same logical CU image as the real pair.

The following table shows the main differences between dummy pair mode and HPAV operations.

Table 8 Differences between TC390A dummy pair mode and HPAV

	TC390A Dummy Pair	HPAV
Paralleling	TC390 Async RIO	Host I/O
Effective for	Single or independent I/O requester	Independent I/O requester (for example, Different job and extend). Due to this reason, possibly HPAV is not effective for IMS WADS.
Requires	At least minimum capacity VSC custom volume	Only LDEV address

General recommendation: When a specific TC390A volume could be a bottleneck due to high write I/O activity:

- If write I/Os are from independent I/O requester, consider dividing I/O activity to different volume (by dataset relocation, for example).
- Otherwise consider using TC390A dummy pair(s).

You can use the PPRC CESTPAIR command as follows to establish TC390A dummy pairs and relationships to real volume pairs. For detailed information on configuring master and dummy pairs using the CESTPAIR TSO command, see ["CESTPAIR"](#) on page 166.

1. CESTPAIR: Establish real volume pair (A-A')
2. CESTPAIR: Establish 1st dummy pair (B-B') for A-A'
3. CESTPAIR: Establish 2nd dummy pair (C-C') for A-A'
4. CESTPAIR: Establish 3rd dummy pair (D-D') for A-A'

TrueCopy Asynchronous Consistency Group Operations

TC390A consistency groups enable update sequence consistency to be maintained across a group of volumes. The R-VOLs of the pairs in a consistency group must be located within one RCU (n-to-1 requirement). The TC390A consistency group operations include the following:

- Group options
- Group consistency time
- Group operations

Only TCzA pairs that belong to the same CLPR can be allocated to one consistency group.

Group Options

TC390A provides the following options for each consistency group: **Timer Type**, **Time Out [Copy Pending]**, and **Time Out [RCU Ready]**. These options are selected when you add a group. If you want to change the **timeout** options of a group, you must suspend all pairs in the group first. If you want to change the **timer type** option, you must delete all pairs. The **Timer Type** and **Time Out [Copy Pending]** options must be the same for all MCUs that contain M-VOLs in the group. The **Time Out [RCU Ready]** option can be different at each MCU if necessary.

Timer Type. This group option determines how the MCU will acquire the time-stamp for the TC390A recordsets:

- **System.** When the **System** timer option is selected, the MCU acquires the time-stamp information for each recordset as follows. When a TC390A pair is established, the MCU reports state-change-interrupt (SCI) to all hosts. The host then issues a series of sense group commands to determine the device status change and the MCU returns the same response as if the device had been added to an XRC session to activate I/O time-stamping for the device. After I/O time-stamping is activated, the MVS IOS routine attaches the time-stamp information (contents of time-of-day (TOD) clock) to each write I/O operation for the device. The time-stamp indicates the time that the update was generated during start subchannel (SSCH) at the main host system and the time-stamp is transferred to the MCU at the beginning of each I/O operation.
- **Local.** The **Local** timer option enables the MCU to generate the time-stamp for each update I/O using its own internal clock, rather than using the SMS I/O time-stamp.
- **None.** The **None** timer option should only be selected when establishing TC390A pairs in the reverse direction (from secondary to primary). When the **None** option is selected, the MCU still acquires the time-stamp information from the host I/O time-stamping function.

Time Out [Copy Pending]. This group option specifies the maximum delay allowed for TC390A copy operations. For instructions on selecting the correct **Time Out [Copy Pending]** setting for your operational environment, see ["Adding Consistency Groups \(Add CT Group\)"](#) on page 109.

The RCU will suspend all R-VOLs in the group when:

- The RCU has not had any communication from the MCU within the specified time. This situation could indicate a disaster or failure at the primary site.

- The RCU has been receiving recordsets from the MCU(s) but has not been able to settle a recordset within the specified time. This situation may indicate that the RCU does not have enough resources to handle the remote copy and I/O workloads.

RCU Ready. This option specifies the maximum delay for re-establishing MCU-RCU communications following MCU power-off. During MCU power-on, the MCU re-establishes communication with all registered RCUs. If it is not able to re-establish communication with an RCU within the specified time, the MCU suspends all affected TC390A volume pairs.

Group Consistency Time

During normal TC390A operations, the consistency time (C/T) of a group corresponds to the time-stamp value of the most recently settled recordset at the RCU. The consistency time for the group is indicated as part of the TC390A R-VOL pair status (also displayed by the CQUERY TSO command to the R-VOL). As the main system continues to update the TC390A M-VOLs, the difference between the current system time and the group consistency time indicates the amount of time that the R-VOLs are behind the M-VOLs. The M-VOL updates that take place during this time may be lost when a disaster occurs.

When a TC390A volume pair is suspended, the C/T of the suspended R-VOL is frozen. If the RCU can ensure the update sequence consistency between the suspended R-VOL and the other R-VOLs in the consistency group, the R-VOL C/T is frozen at the latest consistency time of the group. Otherwise, the R-VOL C/T is frozen at the time-stamp value of the most recent update that was successfully copied to the R-VOL. The C/T of a suspended R-VOL may be older than the C/T of other R-VOLs in the group, and if the entire group was not also suspended, the consistency time of the group is still ticking. For suspended TC390A R-VOLs, the TC390 Pair Status window displays whether the C/T was frozen to the group or R-VOL time.

After you have established TC390A operations, you should monitor the consistency time of each group at the RCU(s). If the average delay is longer than your disaster recovery design can accept, you should consider adding remote copy resources (for example, paths or cache) and/or reducing the I/O workload to improve disk array performance. If the delay between the M-VOL update and the corresponding R-VOL update reaches the time specified by the **Time Out [Copy Pending]** group option, the MCU will suspend all affected volume pair(s) due to the heavy I/O workload (at MCU or RCU). To prevent timeout errors, you can increase the **Time Out [Copy Pending]** value, reduce I/O workload, and/or add remote copy resources.

Group Operations

TC390A provides the following group-based operations to simplify and expedite disaster/failure recovery procedures:

- Group operations at the MCU:
 - Suspend all pairs in a consistency group. For a description of the TC390A **Group** suspend option (supported by CSUSPEND TSO command), see ["Suspending TrueCopy Pairs \(Suspend Pair\)"](#) on page 132.
 - Resume all suspended pairs in a consistency group. For a description of the TC390A **Resume-Group** pair option (supported by the CESTPAIR TSO command with the parameter MODE=RESYNC), see ["Resuming TrueCopy Volume Pairs \(Resume Pair\)"](#) on page 134.
 - Delete all pairs in a consistency group. For a description of the TC390A **Group** delete option (supported by CDELPAR TSO command), see ["Deleting TrueCopy Volume Pairs \(Delete Pair\)"](#) on page 137.
- Group operations at the RCU:
 - Suspend all pairs in a consistency group. For a description of the TC390A **Group** suspend option (supported by CSUSPEND TSO command), see ["Suspending TrueCopy Pairs \(Suspend Pair\)"](#) on page 132.

- Delete all suspended pairs in a consistency group except for any inconsistent pairs. For a description of the TC390A **C/T** delete option (not supported by CDELPAR, CDELPAR cannot be issued to the RCU), see “[Deleting TrueCopy Volume Pairs \(Delete Pair\)](#)” on page 137.
- Delete all pairs in a consistency group regardless of their consistency status. For a description of the TC390A **Group** delete option (not supported by CDELPAR, CDELPAR cannot be issued to the RCU), see “[Deleting TrueCopy Volume Pairs \(Delete Pair\)](#)” on page 137.

TC390A also provides the **Error level** pair option (see “[Creating TrueCopy Volume Pairs \(Add Pair\)](#)” on page 126) that is used to trigger automatic suspension of an entire consistency group. When a TC390A pair is suspended due to failure (not user-requested), this TC390A pair option determines whether all pairs in the same consistency group will also be suspended. If you select the **Group** error level for a TC390A pair, all pairs in the same group will be suspended. If you select the **Volume** error level, only the affected TC390A pair will be suspended.



NOTE: The **Error level** pair option is very important for managing TC390A groups and planning for disaster recovery. The **Group** error level should be selected for all TC390A volumes that are essential to disaster recovery. Suspended TC390A R-VOLs that have the **Volume** error level should not be used for disaster recovery.

TrueCopy Volume Pair Status

TC390A displays the pair status for each volume in the selected logical CU image (CUI) of the connected XP128/XP1024/XP12000. The MCU maintains the status of the M-VOL and is responsible for keeping the M-VOL and its R-VOL synchronized. The RCU maintains the status of the R-VOL. The MCU can change the pair status of the M-VOL and R-VOL. The RCU can change the pair status of the R-VOL but not the M-VOL. The MCU will detect when the RCU changes the R-VOL status (if the path status is normal) and will change the M-VOL status accordingly. The TC390 pair status can be acquired from the MCU and RCU using the TC390 software (Pair Status) and the CQUERY TSO command.

[Table 9](#) on page 47 lists and describes the TC390 volume pair status descriptions. A volume that is not assigned to a TC390 volume pair has the status *simplex*. When a TC390 pair is started, the MCU changes the status of both volumes (M-VOL and R-VOL) to *pending duplex*. When the initial copy operation is complete, the MCU changes the status of both volumes to *duplex*. When a pair is suspended from the MCU, the MCU changes the status of the M-VOL and R-VOL (if the path status is normal) to *suspended*. When a pair is suspended from the RCU, the RCU changes the status of the R-VOL to *suspended*, and the MCU detects the pair suspension (if the path status is normal) and changes the M-VOL status to *suspended*. When you delete a pair from the MCU, the MCU changes the status of the M-VOL and R-VOL (if the path status is normal) to *simplex*. When you delete a pair from the RCU, the RCU changes the R-VOL status to *simplex*, and the MCU detects the pair deletion (if the path status is normal) and changes the M-VOL status to *suspended*.

TC390A-Specific Pair Status

The TC390A *suspending* and *deleting* transitional states occur when a request to change TC390A pair status has been accepted, but the change to the requested status (*suspended* or *simplex*) is not yet complete. These states are not reported to the host. In the case of *suspending*, both the user and the MCU can request the status change. In the case of *deleting*, only the user can request the status change. If the user requested the status change, the final status is reported at the end of the transition. If an error caused the status to change to *suspended*, the suspended status is reported at the beginning of the transition.

The TC390A *SEQCHK* status is indicated when a TC390A pair assigned to a consistency group with the **System** timer type accepts a non-time-stamped update from the primary system. The *SEQCHK* status does not affect TC390A copy activities and will be removed when the next time-stamped update is successfully copied to the R-VOL. However, if a disaster or system failure occurs before the next time-stamped update, the update sequence consistency between the R-VOL and other R-VOLs in the consistency group is not ensured. To ensure effective disaster recovery, you should detect and remove the source of the *SEQCHK* status. The *SEQCHK* status can be caused by any of the following:

- An application may issue update I/Os bypassing the MVS standard I/O procedure.
- The I/O time-stamping function may not be active at the primary system.

Table 9 TrueCopy volume pair status

Pair Status	Description
Simplex	This volume is not currently assigned to a TC390 volume pair. When this volume is added to a TC390 volume pair, its status will change to <i>pending duplex</i> .
Pending Duplex	The TC390 initial copy operation for this volume pair is in progress. This volume pair is not yet synchronized. When the initial copy is complete, the status changes to <i>duplex</i> .
Duplex	This volume pair is synchronized. Updates to the M-VOL are duplicated on the R-VOL.
Suspended (see Table 10 on page 48 for suspend types)	<p>This volume pair is not synchronized:</p> <p>For TC390 Synchronous only, if the MCU cannot keep the pair synchronized for any reason, the MCU changes the status of the M-VOL and R-VOL (if possible) to <i>suspended</i>.</p> <p>For TC390A only, if the MCU detects a TC390A suspension condition (see "Suspended TrueCopy Asynchronous Pairs" on page 50), the MCU changes the M-VOL status and R-VOL status (if possible) to <i>suspended</i>.</p> <p>For TC390A only, when the RCU detects a TC390A suspension condition (see "Suspended TrueCopy Asynchronous Pairs" on page 50), the RCU changes the R-VOL status to <i>suspended</i>.</p> <p>For TC390 Synchronous only, the MCU changes the status of all TC390 Synchronous pairs to <i>suspended</i> when it performs the CGROUP/RUN command (see "CGROUP (FREEZE/RUN) Support" on page 174).</p> <p>When you suspend a pair from the MCU, the MCU changes the status of the M-VOL and R-VOL (if possible) to <i>suspended</i>. When you suspend a pair from the RCU, the RCU changes the status of the R-VOL to <i>suspended</i>.</p> <p>When the MCU detects that the pair was <i>suspended</i> or deleted from the RCU, the MCU changes the status of the M-VOL to <i>suspended</i>.</p>
Pair Status for TC390A only:	
Suspending	This pair is not synchronized. This pair is in transition from <i>duplex</i> or <i>pending duplex</i> to <i>suspended</i> . When the suspension is requested (by user, MCU, or RCU), the status of all affected pairs changes to <i>suspending</i> . When the suspension is complete, the status changes to <i>suspended</i> .
Deleting	This pair is not synchronized. This pair is in transition from <i>duplex</i> , <i>pending duplex</i> , or <i>suspended</i> to <i>simplex</i> . When the delete pair operation is requested (by user), the status of all affected pairs changes to <i>deleting</i> . When the delete pair operation is complete, the status changes to <i>simplex</i> .
SEQCHK	The RCU encountered a non-time-stamped recordset for a TC390A pair using the System timer type option. This status can be displayed at the MCU and RCU, but the MCU may not have the most current information. Always use the pair status information displayed at the RCU for disaster recovery.

Suspended Pairs

[Table 10](#) on page 48 lists and describes the TC390 suspend types, which indicate the reason for suspension. A user can suspend a TC390 pair at any time after the initial copy operation is complete. The user must suspend a TC390 pair to perform ICKDSF maintenance on the M-VOL or to access the R-VOL

(read only mode). TC390 pairs are also suspended when the CGROUP/ RUN command is processed (see ["CGROUP \(FREEZE/RUN\) Support" on page 174](#)). When the user suspends a TC390 Synchronous pair, the MCU ensures synchronization by completing any pending update copy operation before changing the status to *suspended*. When the user suspends a TC390A pair, the MCU and RCU ensure synchronization by either completing or discarding any pending update copy operations according to the user-specified drain/purge suspend option.

A TC390 pair is suspended by the MCU when any of the following suspension conditions are detected. A TC390A pair can also be suspended by the RCU (see ["Suspended TrueCopy Asynchronous Pairs" on page 50](#)).

- When the MCU detects that the user has deleted the volume pair from the RCU (for example, to access an R-VOL at the remote site).
- When the MCU detects an error condition related to the RCU, R-VOL, a TC390 Synchronous update copy operation or a TC390A recordset operation (see ["Suspended TrueCopy Asynchronous Pairs" on page 50](#)).
- When the RCU cannot execute DFW (DASD fast write) to the R-VOL (only if **DFW required** is selected).
- When the MCU is unable to communicate with the RCU.

If a TC390 Synchronous update copy operation fails, the MCU maintains exact synchronization by reporting a unit check and decommitting the M-VOL update so that the host system and application program regard that write operation to the M-VOL as failed. For information on failed TC390A recordset operations, see ["Suspended TrueCopy Asynchronous Pairs" on page 50](#).

When a TC390 pair is suspended, the MCU stops performing update copy operations to the R-VOL. For a suspended TC390 Synchronous pair, the MCU may or may not continue accepting write I/Os for the M-VOL depending on the M-VOL fence level and suspend option (if user-requested). If the MCU accepts write I/Os for a suspended M-VOL, the MCU keeps track of the M-VOL cylinders that are updated while the pair is suspended. For a suspended TC390A pair, the MCU and RCU keep track of any recordsets that were discarded during suspension, and the MCU continues accepting write I/Os for the M-VOL and keeps track of the M-VOL cylinders that are updated while the pair is suspended.

A suspended TC390A R-VOL has an additional status called the consistency status that is displayed only at the RCU. The consistency status of a suspended TC390A R-VOL indicates its update sequence consistency with respect to the other R-VOLs in the same group. [Table 11](#) on page 49 lists and describes the consistency status descriptions for suspended TC390A R-VOLs.

When a TC390 pair is suspended, whether user-requested or due to failure, the MCU generates sense information to notify the host(s). If the host system supports IBM PPRC and the PPRC support RCU option is enabled, this notification results in an IEA494I and/or IEA491E system console message that indicates the reason for suspension. For more information on the IEA494I and IEA491E system console messages, see ["IEA494I and IEA491E Console Messages" on page 180](#).



NOTE: If you need write access to an R-VOL, you must delete the pair.

Table 10 Suspend types

Suspend Type	Applies to	Description
M-VOL by operator	M-VOL (TC390 Sync only)	The user suspended the pair from the MCU using the M-VOL Failure option. The R-VOL suspend type is by MCU.
R-VOL by operator	M-VOL, R-VOL	The user suspended the pair from the MCU or RCU using the R-VOL option.

Table 10 Suspend types (continued)

Suspend Type	Applies to	Description
by MCU	R-VOL	The RCU received a request from the MCU to suspend the volume pair. The M-VOL suspend type is M-VOL by Operator or R-VOL by Operator.
by RCU	M-VOL	The MCU detected an error condition at the RCU that caused the MCU to suspend the TC390 volume pair. The R-VOL suspend type is by MCU.
Delete Pair to RCU	M-VOL	The MCU detected that the R-VOL status changed to simplex because the user deleted the pair from the RCU. The pair cannot be resumed because the R-VOL does not have the suspended status.
R-VOL Failure	M-VOL	The MCU detected an error during communication with the RCU or an I/O error during update copy. In this case, the R-VOL suspend type is usually by MCU.
MCU IMPL	M-VOL, R-VOL	The MCU could not find valid control information in its nonvolatile memory during the IMPL procedure. This condition occurs only if the MCU is completely without power for more than 48 hours (for example, power failure and fully discharged backup batteries).
Initial Copy failed	M-VOL, R-VOL	The volume pair was suspended before the initial copy operation was complete. The data on the R-VOL is not identical to the data on the M-VOL.
by FREEZE	M-VOL, R-VOL (TC390 Sync only)	The volume pair was suspended by the CGROUP/RUN TSO command. See "CGROUP (FREEZE/RUN) Support" on page 174.
MCU P/S-OFF	R-VOL (TC390A only)	The RCU received a request from the MCU to suspend the R-VOL due to MCU power-off. The RCU stops expecting recordsets from that MCU.
by sidefile overflow	M-VOL, R-VOL (TC390A only)	The amount of sidefile exceeds the specified "current pending update data rate" and the RCU data is not transferred within the specified "offloading timer".

Table 11 Consistency status for suspended TrueCopy Async R-VOLs

Consistency Status	Description
Volume	<p>This TC390A volume pair was probably suspended alone. Update sequence consistency between this R-VOL and other R-VOLs in this consistency group is not ensured. This R-VOL cannot be used for disaster recovery at the secondary system. This status is indicated when:</p> <p>This volume pair was suspended due to a failure that did not affect the entire consistency group and the Error Level pair option for this pair is set to Volume.</p> <p>This volume pair was suspended by a user-initiated suspend pair operation with the TC390A Suspend (Async) suspend option set to Volume.</p>

Table 11 Consistency status for suspended TrueCopy Async R-VOLs (continued)

Consistency Status	Description
Group	<p>This TC390A volume pair was suspended along with the other pair in its consistency group. Update sequence consistency between this R-VOL and other R-VOLs in this consistency group is ensured. This R-VOL can be used for disaster recovery at the secondary system after deleting the TC390 volume pair from the RCU. This status is indicated when:</p> <p>All volume pairs in this consistency group were suspended due to a failure that affected the entire consistency group, not just one pair (for example, MCU-RCU communication failure).</p> <p>The volume pair was suspended due to a failure that did not affect the entire group and the Error Level TC390A pair option for this pair is set to Group.</p> <p>This volume pair was suspended by a user-initiated suspend pair operation with the TC390A Suspend (Async) suspend option set to Group.</p>

Suspended TrueCopy Asynchronous Pairs

TC390A operations involve additional suspension conditions related to the asynchronous recordset operations. Both the MCU and RCU can detect TC390A suspension conditions and suspend TC390A pairs. The following table describes the TC390A suspension conditions and indicates which CU detects the condition and which volume pairs are suspended. The TC390A offloading timer asynchronous option (see ["Asynchronous Copy Option"](#) on page 112) and timeout group options (see ["Adding Consistency Groups \(Add CT Group\)"](#) on page 109) are used to control the TC390A suspension conditions. For troubleshooting information for TC390A suspension conditions, see [Table 27](#) on page 159.

Table 12 TrueCopy Asynchronous suspension conditions

Suspension Condition	Detected by	TC390A Pairs to be Suspended
The MCU could not send a pending recordset to the RCU before the offloading timer asynchronous option expired. See "Inflow Control of Recordsets" on page 40.	MCU	All TC390A pairs with M-VOLs in the MCU.
During MCU power-on, the MCU could not establish communication with the RCU before the RCU ready timeout group option expired. See "Group Options" on page 44.	MCU	All TC390A pairs with M-VOLs in the MCU.
The RCU could not settle a pending recordset before the copy pending timeout group option expired.	RCU	All TC390A R-VOLs in the consistency group.
The RCU could not communicate with the MCU before the copy pending timeout group option expired.	RCU	All TC390A R-VOLs in the consistency group.
The RCU could not receive the recordset successfully due to a hardware failure.	RCU	Only the affected R-VOL.
The RCU detected a logical error while selecting the recordset to be settled.	RCU	All TC390A R-VOLs in the group, or only the affected R-VOL, depending on the failure type and error level
The RCU could not settle the recordset due to a hardware failure, a track condition, or a logical error.	RCU	TC390A pair option.

The MCU stores a cylinder bitmap in cache for each TC390A M-VOL and the RCU stores a cylinder bitmap in cache for each TC390A R-VOL. When a TC390A pair is suspended, the cylinders that contain the following records are marked in the cylinder bitmap as modified (to be copied during the resume pair operation):

- The recordsets that were created by the MCU but not yet sent to the RCU. After marking these cylinders as modified, the MCU discards these recordsets.
- The recordsets that were sent to the RCU but not acknowledged by the RCU. The MCU marks these M-VOL cylinders as modified and discards these recordsets. This ensures that recordsets that are lost during transmission to the RCU are identified and marked.
- The recordsets that reached the RCU but have not yet been settled. After marking these cylinders as modified, the RCU discards these recordsets.
- The M-VOL records updated by host-requested write I/Os after the volume pair was suspended (same function as for TC390 Synchronous pairs).

When a suspended TC390A pair is resumed (resynchronized), the contents of the RCU's cylinder bitmap are sent to the MCU and merged into the MCU's cylinder bitmap. The MCU then performs the resync copy operation according to the merged bitmap. This ensures that all cylinders containing recordsets that were discarded are resynchronized at this time.

PPRC Support

An XP128/XP1024/XP12000 with TC390 installed supports IBM PPRC host software functions. You can perform most TC390 operations by issuing PPRC TSO (or ICKDSF PPRCOPY) commands from the host system console to the XP128/XP1024/XP12000. Using PPRC commands, you can establish and delete remote copy communication paths; establish, suspend, resume, and delete TC390 Synchronous and TC390A pairs/groups; and view TC390 path and pair status. For more information on using PPRC TSO and ICKDSF commands with the XP128/XP1024/XP12000, see ["Using PPRC Commands for TrueCopy"](#) on page 160.

For operating systems that do not support PPRC, TC390 through Command View is used to control and monitor TC390 operations. In this case, TC390 provides only state-change-pending (SCP) notifications with service information messages (SIMs).

Restrictions. If you plan to use PPRC commands instead of the TC390 software to perform TC390 operations, the following restrictions apply:

- **SVP mode 114** (see [Table 3](#) on page 28) must be enabled to allow automatic port configuration in response to PPRC commands. To fully support an automated environment, the XP128/XP1024/XP12000 is capable of automatically configuring a serial port as an RCP or LCP, or a Fibre Channel port as an initiator or RCU target port if required in response to the TSO CESTPATH and CDELPATH commands. The XP128/XP1024/XP12000 will verify that the specified MCU port is offline to the host and will automatically configure it as an RCP or initiator port if required. Similarly, the corresponding RCU port will also be configured as an LCP or RCU target port if required. When the CDELPATH command is issued, the TC390 logical paths are removed, and if there are no more TC390 or TC logical paths on the port, the port is automatically changed from RCP mode to LCP mode, or from initiator port mode to RCU target port mode.



NOTE: For Fibre Channel interface, do not use the CESTPATH and CDELPATH commands at the same time as the SCSI path definition function of LUN Management. The Fibre Channel interface ports need to be configured as initiator ports or RCU target ports before the CESTPATH and CDELPATH commands are issued.



CAUTION: Before issuing the CESTPATH command, verify that the relevant paths are offline from the host(s) (for example, configure the Chipid offline, deactivate the LPAR, or block the port in the ESCD). If any active logical paths still exist, the add path operation will fail because the port mode (LCP/RCP) cannot be changed.

- You cannot use the PPRC commands to:

Change the RCU options. The current default values are: minimum paths = 1, max. initial copy activity = 4, SCP delay time = 120 seconds, incident of RCU = to any host, PPRC support = yes, remote copy service SIM = not report, RIO MIH Time = 15 seconds. The TC390 software must be used to change these options.

Change the TC390 async options. The current default values are: sidefile threshold = 50%, offloading timer = 5 minutes. The TC390 software must be used to change these options.

Configure TC390A consistency groups. Because each TC390A pair must belong to one group, the TC390 software must be used to add and configure the groups (timer type, copy pending timeout, RCU ready timeout) before you can add any TC390A pairs. After the asynchronous options, groups, and group options are configured, the PPRC commands can be used to control/monitor TC390A pairs.

Change the initial copy priority. CFW data option, or DFW to R-VOL option. If CESTPAIR is used to establish a TC390 pair, the following options will be used: initial copy priority = 0, CFW data = copy to R-VOL¹, and DFW to R-VOL = not required. The TC390 software must be used to change these options.



NOTE: The DFW to R-VOL setting does not affect the I/O performance of the M-VOLs. If one side of cache is closed due to an RCU failure, the TC390 copy operation still uses DFW. The only difference between **not required** and **required** is that new pairs cannot be established with the **DFW-to-R-VOL required** option when one side of RCU cache is closed (the add pair operation fails).

P/DAS Support

TC390 Synchronous supports the IBM P/DAS host software function. You can use P/DAS to relocate or migrate data by redirecting all application I/Os from the M-VOL of a TC390 pair to the R-VOL without interrupting access to the data. TC390A does not support P/DAS SWAP.

Restrictions

- P/DAS does not support CFW operations. You must stop CFW applications before performing P/DAS operations on TC390 volumes.
- P/DAS through channel extenders is not supported.
- P/DAS swap option #2 (switch pair and swap) is supported for P/DAS between the XP128/XP1024/XP12000 and other XP disk arrays.

Contact your HP account support representative for the latest information on P/DAS support.

GDPS Support

TC390 provides remote copy support for IBM's Geographically Dispersed Parallel Sysplex (GDPS) facility. GDPS is an IBM service offering for mirroring data and balancing workload on disk arrays spread across two or more sites up to 40 km (~20 miles) apart. With this support, users who are running IBM Parallel

1. By using Remote Copy Function Switch, you can set the following option with PPRC command: CFW data = only M-VOL. If you want to use this function, please contact your HP account support representative.

Sysplex systems can take advantage of the XP128/XP1024/XP12000 suite of remote copy options for data availability.

GDPS operations feature automatic control of groups of PPRC-managed volumes using host-based scripts and PPRC commands (for example, CESTPATH CGROUP option for 2105, CGROUP (FREEZE/RUN) for 3990). GDPS support may have additional installation requirements for the XP128/XP1024/XP12000 TC390 MCUs and RCUs, depending on XP128/XP1024/XP12000 microcode levels and Command View software versions. Check the following items with your HP representative:

- SVP modes. For operations in a GDPS environment:

Mode 64 must be OFF.

Mode 104 must be ON for 3990 controller emulation (not valid for 2105 emulation).

For more information on XP128/XP1024/XP12000 SVP modes related to TC390 operations, refer to [Table 3](#) on page 28.

Mode 104 must be set before any TC390 pairs are established in a GDPS environment. If TC390 pairs have already been established, you must delete all pairs and logical paths (CDELPAIR, CDELPATH), change the SSIDs and mode settings on the MCUs and RCUs, and then re-establish the paths and pairs (CESTPATH, CESTPAIR). Installation of mode 64 is nondisruptive and can be performed at any time.

Preparing for TrueCopy Operations

System Requirements

TC390 operations involve the XP128/XP1024/XP12000 MCUs and RCUs containing the main and remote volumes, the remote copy connections between the MCUs and RCUs, the zSeries and S/390 host(s) at the main and remote sites, and TC390 running through Command View.

The TC390 system requirements are:

- **MCU:** XP128/XP1024/XP12000 with TC390 installed.
- **RCU:** XP128/XP1024/XP12000 with TC390 installed.



NOTE: Other XP disk arrays with TC390 installed can be used as an RCU connected to an XP128/XP1024/XP12000 MCU. For assistance with mixed disk array configurations, contact your HP account support representative.

TC390 can coexist with CA (all copy modes) in the same XP128/XP1024/XP12000. Full Fibre Channel support will allow concurrent fibre-mode CA and TC390 operations.

The XP128/XP1024/XP12000 may have additional installation requirements, such as SVP modes, hardware features such as CHF WP411-B, additional cache, and so forth. For more information on XP128/XP1024/XP12000 SVP modes for TC390, refer to [Table 3](#) on page 28.

-
- **Serial remote copy connections** (see ["Serial Remote Copy Connections"](#) on page 60):
 - Multimode serial interface (ESCON) cables are required at both the MCU and RCU.
 - For distances from 3 km to 43 km (1.9 to 26.7 miles), single-mode serial interface cables with IBM 9032 or 9033 ESCON directors (ESCDs) and/or 9036 ESCON repeaters are required.
 - For distances greater than 9 km (5.6 miles), the extended distance facility (XDF) provided by the ESCDs and/or ESCON repeaters is required.

- For distances greater than 43 km (26.7 miles), approved third-party channel extender products and telecommunications lines are required. Long-distance TC390 solutions are provided based on user requirements and workload characteristics.



NOTE: Use of channel extenders may require additional XP128/XP1024/XP12000 configuration (for example, mode 21).

All serial remote copy activities between two XP128/XP1024/XP12000s, such as TC390, TC390A, CA Sync, and CA Async, can share the same remote copy connections.

- **Remote copy connections – Fibre Channel** (see [“Fibre Remote Copy Connections”](#) on page 58):
 - Multimode or single-mode optical fibre cables are required at both the MCU and RCU.
 - For distances from 0.5 km to 1.5 km (1,640 to 4,920 feet), multimode shortwave Fibre Channel interface cables with up to two switches are required.
 - For distances from 10 km to 30 km (6.2 to 18.6 miles), single-mode longwave Fibre Channel interface cables with up to two switches are required.
 - For distances greater than 30 km, approved third-party channel extender products and telecommunications lines are required.
- **zSeries and S/390 host:** MVS/DFP 3.2.0 + PTF, or VM/ESA 2.1.0 + PTF.
 - Optional error recover procedure (ERP) functions require MVS/DFP 3.2.0 or later.
 - ICKDSF R16 + PTF functions require VM/ESA 2.1.0 or later.
 - If the primary and/or secondary system consists of several CPU complexes, a **SYSPLEX timer** is required to provide a common time reference for the host I/O time-stamping function.
 - APAR OW36948 is required for 16-session support for HXRC.
- **Command View management station and software.** The Command View management station is supplied by the user. The Web browser is required to operate the Command View Java Applet programs. Also, the license key code is required to operate the TC390 software.



NOTE: Administrator access to the Command View management station is required to perform TC390 operations. Users without administrator access can only view TC390 information.

- **TC390 option(s)** enabled on the XP128/XP1024/XP12000 and on the Command View management station (see [“Installing the TrueCopy Software”](#) on page 62).

Requirements and Restrictions

TC390 has the following requirements and restrictions:

- Track format
- One-to-one volume copy operations
- Duplicate VOLSER (Volume Serial Number)
- Logical volume image (LVI) (also called device emulation or device type)
- Accessing TC390 M-VOLs and R-VOLs
- Cache, NVS, and DASD fast write

- Consistency groups

Track Format

TC390 has the following disk track format requirements that the user must follow. TC390 cannot detect exceptions to these requirements. The MCU will abort the TC390 initial copy operation if the track format for both the M-VOL and R-VOL does not meet the following requirements:

- The TC390 M-VOL and R-VOL must have the same track format.
- Record zero (R0) must be standard format, with key length of zero and data length of eight. The MCU will abort the initial copy operation if R0 is not standard format.
- The CCHH (logical cylinder address and logical head address) of R0 must be identical to the physical cylinder address and physical head address of the track.
- The CCHH of each user record in a track must be unique.

One-to-One Volume Copy Operations

TC390 requires a one-to-one relationship between the logical volumes of the volume pairs. A volume can be assigned only to one TC390 pair at a time. TC390 does not support operations in which one M-VOL is copied to more than one R-VOL, or more than one M-VOL is copied to one R-VOL. Because TC390 pairs are created on logical volumes rather than datasets, multivolume datasets require special attention. For complete duplication and recovery of multivolume datasets, verify that all volumes of a multivolume dataset are copied to TC390 R-VOLs and use TC390A to ensure update sequence consistency across the R-VOLs at the remote site.

Duplicate VOLSER

The TC390 initial copy operation always copies the VOLSER of the M-VOL to the R-VOL, even if the **No Copy** initial copy option is selected. For this reason, the M-VOL and R-VOL of a TC390 pair must have the same VOLSER. Because the host operating system does not allow duplicate VOLSERs, the host system administrator must take precautions to prevent system problems related to duplicate VOLSERs. For example, the TC390 R-VOLs must be defined in the system generation so they do not come online automatically.



CAUTION: If the volumes that will become TC390 R-VOLs are physically attached to the same system images as the production volumes that will become the TC390 M-VOLs, the following problems can occur:

- When a TC390 pair is established using the TSO CESTPAIR command, the secondary volume might be online. PPRC allows this, but TC390 does not (see the following note). This could produce a duplex secondary online to a host image, the results of which are not predictable.
- When a TC390 pair is deleted, the old secondary volume is usually offline. If a host image is IPL'd, the operator will be offered both volumes and asked which volume should be left offline – the old duplicate volser message. This can be confusing and is prone to error.
- To avoid these problems, HP strongly recommends that the user specify OFFLINE=YES if the secondary volumes are to be generated in the production host's IOCP and system generation.



NOTE: If you cannot create a pair because the TC390 R-VOL is online with hosts, all paths must be offline from all hosts. If you cannot identify the hosts that are online, please contact your HP account support representative.

Logical Volume Image (LVI)

TC390 supports basic mainframe LVIs that can be configured on the XP128/XP1024/XP12000 (for example, 3390-3, -3R, -9, or -L). TC390 does not support multiplatform volumes (3390-1, -2, -3A/B/C, 3380-K, -E, -J, or -KA/B/C). TC390 can copy data between volumes with the same emulation and capacity (for example, 3390-3R to 3390-3R), and can also copy from smaller volumes to larger volumes (for example, 3390-3 to 3390-3R) of the same emulation (VTOC expansion must be used). TC390 also supports the Virtual LVI/LUN feature of the XP128/XP1024/XP12000 to establish TC390 pairs with custom-size LVIs as well as standard-size LVIs. When custom-size LVIs are assigned to TC390 pairs, the R-VOL must have the same or larger capacity than the M-VOL. TC390 displays the LVI of the M-VOLs and R-VOLs.



NOTE: The host I/O time-stamping function is not supported by 3380 LVIs. If you plan to use TC390A pairs, the TC390A M-VOLs and R-VOLs must be 3390 LVIs.

In the case that M-VOL or R-VOL is 3390-L LVI under the connection of the disk array, and the number of cylinders is more than 10,017, the capacity of the M-VOL and R-VOL must be the same.



CAUTION: If you use TC390 to copy from a smaller volume to a larger volume, you will not be able to perform TC390 operations in the reverse direction (from the secondary site to the primary site) after a disaster has occurred and the secondary site was used for production. This restriction exists because TC390 does not support copying from a larger volume to a smaller volume. HP strongly recommends that this capability (copying from a smaller volume to a larger volume) only be used for data migration purposes.

Accessing TrueCopy M-VOLs and R-VOLs

Write operations to a TC390 M-VOL that specify normal authorization are duplicated on the R-VOL of the TC390 pair. Write operations with diagnostic or device support authorization, such as ICKDSF, are completed at the M-VOL but are not duplicated at the R-VOL. Therefore, you must suspend a TC390 volume pair before performing ICKDSF media maintenance on the M-VOL. For instructions on running ICKDSF on TC390 volumes, see ["ICKDSF Considerations for TrueCopy Volumes"](#) on page 142.

To ensure maximum data integrity during normal TC390 operations, the RCU rejects all read and write operations issued by a host to a TC390 R-VOL. If you need read-only access to a TC390 R-VOL, you must have the R-VOL read option (see ["R-VOL Read Option"](#) on page 37) enabled on the RCU and you must suspend the pair to read the R-VOL. The R-VOL read option can be enabled by the HP representative only. If you need write access to a TC390 R-VOL (for example, to perform ICKDSF), you must delete the pair from the RCU to change the R-VOL pair status to *simplex*. For instructions on running ICKDSF on TC390 volumes, see ["ICKDSF Considerations for TrueCopy Volumes"](#) on page 142.

Cache, NVS, and DASD Fast Write

Cache and nonvolatile storage (NVS) must be operable for both the MCU and RCU of a TC390 volume pair. If not, the Add Pair operation will fail. The remote disk array cache should be configured to adequately support the TC390 remote copy workloads as well as any local workload activity.

DASD fast write (DFW) is required at the MCU and RCU only when the **DFW-to-R-VOL required** TC390 pair option (see ["Creating TrueCopy Volume Pairs \(Add Pair\)"](#) on page 126) is specified. If DFW to an R-VOL is blocked and the TC390 pair was established with the **DFW-to-R-VOL required** pair option, the MCU detects DFW OFF at the R-VOL and suspends the pair. TC390 pairs that were established using PPRC commands use the default value of **not required** and therefore are not suspended when DFW to the R-VOL is blocked.



NOTE: The DFW to R-VOL setting does not affect the I/O performance of the M-VOLs. If one side of cache is closed due to an RCU failure, the TC390 copy operation still uses DFW. The only difference between **not required** and **required** is that new pairs cannot be established with the **DFW-to-R-VOL required** option when one side of RCU cache is closed (the add pair operation fails).

Consistency Groups

The TC390A consistency groups have the following requirements:

- All TC390A pairs must be assigned to one and only one consistency group.
- The maximum number of volume pairs in one consistency group is 4,096 (entire RCU).
- The maximum number of consistency groups established for one MCU-RCU pair is 128. The RCU supports a maximum of 128 groups. This limit of 128 groups includes both TC390A groups and TC Asynchronous groups (for example, 64 TC390A + 64 CA Asynchronous).
- Each update I/O to the M-VOLs in one consistency group must be time-stamped using a common timer facility. The primary host system cannot access volume pairs of the same consistency group if the pairs do not have a common timer reference.
- A consistency group must consist of TC390A pairs or CA Asynchronous pairs, but not both.

Installing the TrueCopy Hardware

Initial installation of the TC390 hardware is planned and performed by the user and the HP representative. To install the hardware required for TC390 operations:

1. **User:** Identify the TC390 M-VOLs and R-VOLs (main and remote volumes) so that the TC390 hardware can be installed and configured properly.
2. **User:** On the host operating system, verify that the missing interrupt handler (MIH) value (also called host I/O patrol time) is set high enough to accommodate the number of volume pairs, the cable length between the MCUs and RCUs, and the initial copy pace. The recommended MIH value for TC390 operations is 60 seconds. For MVS, the MIH value is specified in the SYS1.PARMLIB file.



NOTE: The recommended MIH value for HXRC is different than for TC390. If you are performing TC390 and HXRC on the same XP128/XP1024/XP12000 (or other XP disk arrays) at the same time, contact your HP account support representative for assistance.

3. **User and HP Representative:** Install the Command View management station near the TC390 MCU(s) and connect the Command View management station to the TC390 MCU(s) through the LAN. HP recommends that you also install a Command View management station connected to the RCUs at the remote site.
4. **HP Representative:** Enable TC390 on all MCUs and RCUs. Verify that the cache, NVS, and DFW of the MCUs and RCUs are properly configured for TC390 operations. See ["Cache, NVS, and DASD Fast Write"](#) on page 56. If the user plans to perform TC390A and/or HXRC operations in the same disk array, make sure to install adequate cache to handle the increased sidefile usage. When determining the required amount of cache, you must also consider the amount of Cache LUN XP data to be stored in cache.
5. **HP Representative:** Verify that the necessary SVP modes are enabled. See [Table 3](#) on page 28.
6. **HP Representative:** Verify the MCUs are configured to report sense information to the host(s). The RCUs should also be attached to a host processor to enable reporting of sense information in case of a problem with an R-VOL or RCU. If the remote site is unattended, the RCUs should be attached to a host

processor at the main site so that the system administrator can monitor the operational condition of the RCUs.

7. **HP Representative:** For serial interface connections, install the serial port adapter features. For example, the DKC-F410I-8S serial 8-port adapter (pair of 4-port CHE cards, 1 card per cluster) provides eight ESCON links. If the MCU and RCU are multiplatform disk arrays, there may be available serial interfaces and additional serial port adapter features may not be required. For Fibre Channel interface connections, install the Fibre Channel adapter features (CHF P/K (WP411-B)).
8. **HP Representative:** If the user plans to use the **Local** TC390A timer type option, set the SVP clock to local time so that the TC390A timestamps will be correct.
9. **HP Representative:** Install the TC390 remote copy connections between the MCU(s) and RCU(s). This hardware (ESCON cables, ESCON directors, optical fibre cables, switches, and so forth) is supplied by the user. For remote copy configurations, see "[Serial Remote Copy Connections](#)" on page 60. Distribute the paths between different storage clusters and ESCDs or switches to provide maximum flexibility and availability. The logical paths between the MCU and RCU must be separate from the logical paths between the host and RCU. For serial interface connections, all remote copy activities between two XP128/XP1024/XP12000s, such as TC390, TC390A, CA Sync, and CA Async, can share the same remote copy connections. For Fibre Channel interface connections, only TC390 activities (Sync and Async) can share the same fibre remote copy connections (future support will eliminate this restriction). For information on using channel extenders, see "[Channel Extenders for Serial Remote Copy Connections](#)" on page 62.

Fibre Remote Copy Connections

The following figure shows the remote copy connection configurations for Fibre Channel interface TC390 operations. The MCU and RCU of each TC390 pair must be connected through multimode shortwave or single-mode longwave optical fibre cables. If you use multimode shortwave optical fibre cables, fibre cables up to 1.5 km in length and up to two switches are required for distances greater than 0.5 km. If you use single-mode longwave optical fibre cables, fibre cables up to 30 km in length and up to two switches are required for distances greater than 10 km. TC390 operations can be performed at distances of up to 30 km (18.6 miles) using standard single-mode longwave support. Long-distance solutions are provided using approved channel extenders and communication lines.

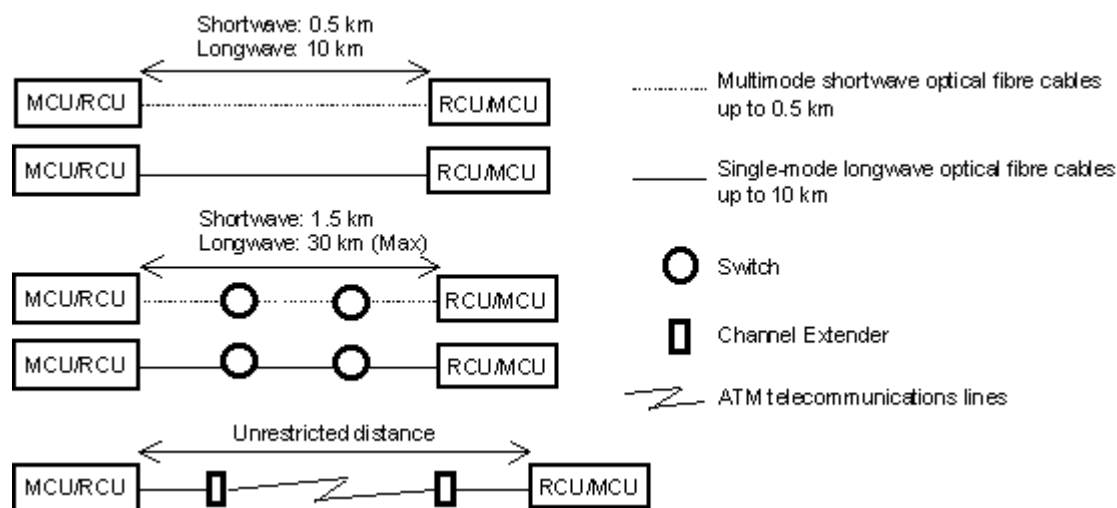


Figure 7 Fibre Channel remote copy connection configurations



NOTE: For Fibre Channel interface connections, you can use the switches as for ordinary switch connections and no special settings are required for the XP128/XP1024/XP12000.

Fibre Channel interface connection provides three different configurations:

- **Direct connection:** Two devices are connected directly together.

In the following figure: * To set ports, use LUN Management and set port topology to: Fab off, FC-AL.

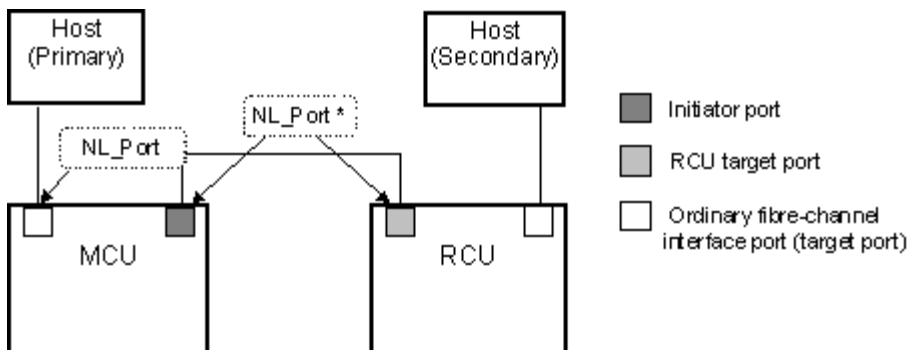


Figure 8 Fibre Channel interface direct connection (NL port)

- **Switch connection:** Up to three optical fibre cables are connected together through the switches to connect the devices. Up to two switches can be used.

In the following figure:

1. Some switch vendors require F port (for example, McData ED5000).
2. To set ports, use LUN Management and set port topology to:
 - NL port: Fab on, FC-AL
 - N port: Fab on, Point-to-Point

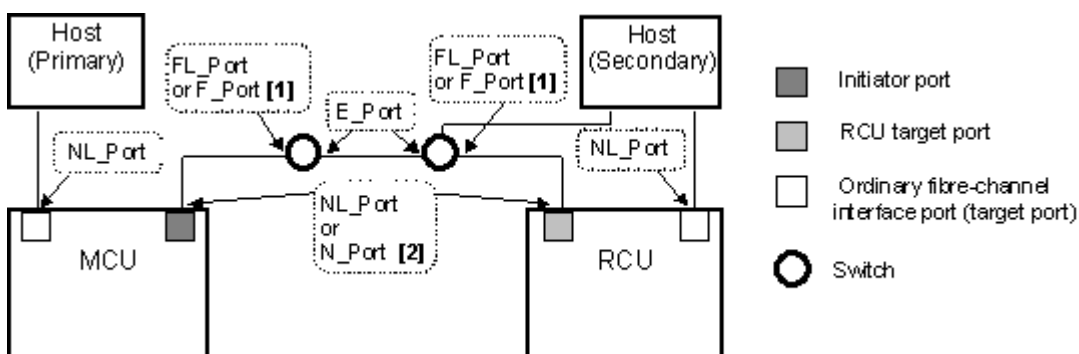


Figure 9 Fibre Channel interface switch connection (FL port or F port)

- **Extender connection:** Channel extenders and switches are used to connect the devices across large distances.

In the following figure: * To set ports, use LUN Management and set port topology to:

- NL port: Fab on, FC-AL

- N port: Fab on, Point-to-Point

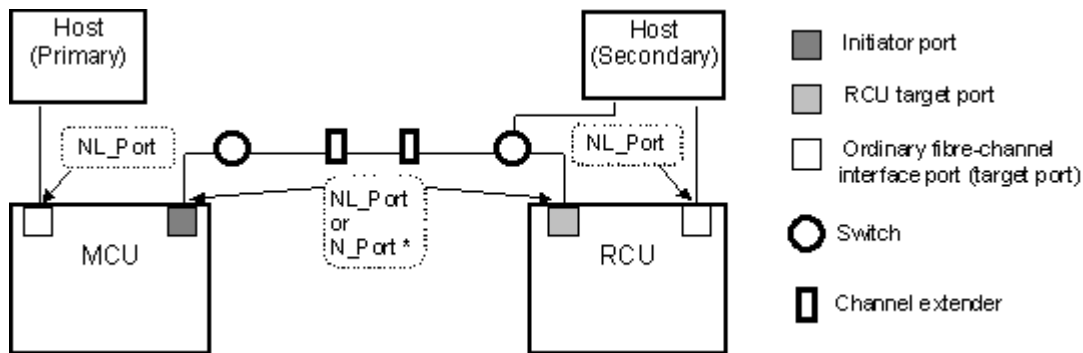


Figure 10 Fibre Channel interface extender connection

Serial Remote Copy Connections

The following figure shows the TC390 serial remote copy connection configurations. The MCU and RCU of each TC390 pair must be connected through multimode ESCON cables. For distances greater than 3 km, single-mode cables up to 20 km in length and IBM 9032/9033 ESCDs and/or 9036 ESCON repeaters are required. Dedicated ESCON channels may be installed, or existing ESCON channels connected by ESCDs may be used. The IBM 9032/9033 ESCD supports the extended distance facility (XDF), which uses single-mode ESCON cables up to 20 km. The IBM 9036 ESCON repeater supports single-mode-to-single-mode connection or single-mode-to-multimode connection. When TC390 disk arrays are more than 9 km apart, the XDF connections provided by the ESCDs or ESCON repeaters are required. TC390 operations can be performed at distances of up to 43 km (26.7 miles) using standard ESCON support. Long-distance solutions are provided, based on user requirements and workload characteristics, using approved channel extenders and communication lines.

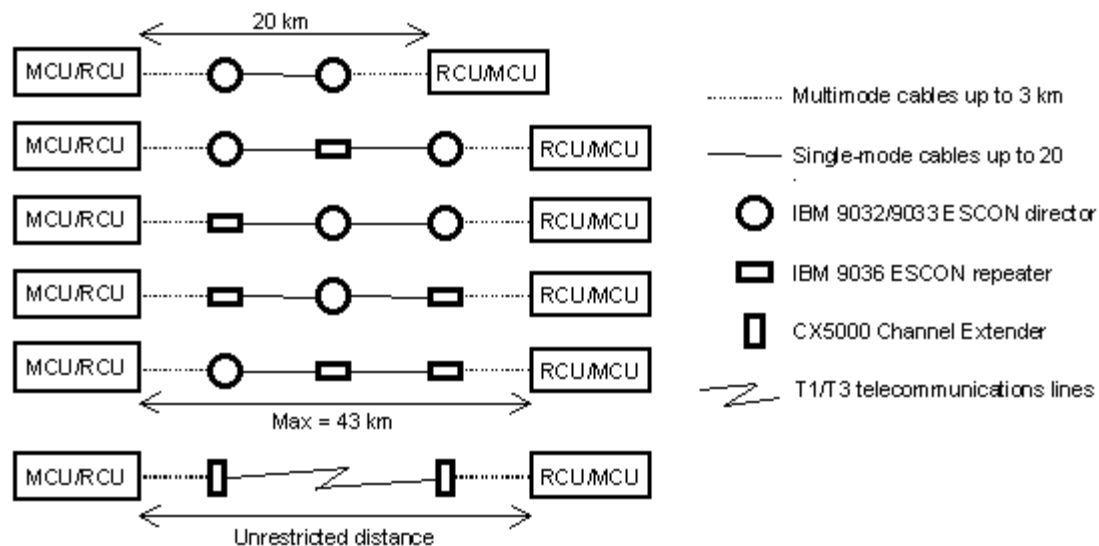


Figure 11 Serial remote copy connection configurations

The ESCDs can accommodate multiple MCU-RCU remote copy connections.

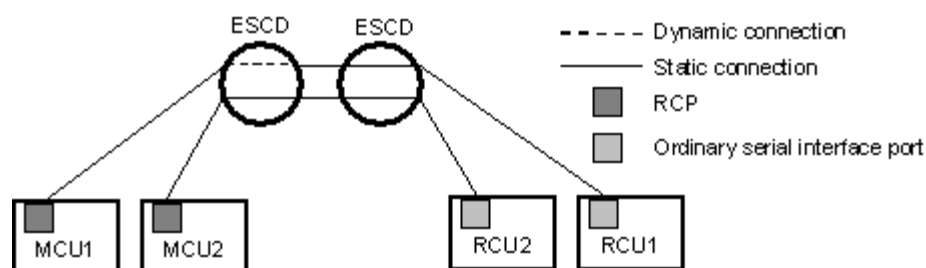


Figure 12 N pairs of remote copy connections

N-to-1 or 1-to-n remote copy connections ($n \leq 4$) can also be configured by using the dynamic switching capability of the ESCDs to share the physical interface cables between the components.

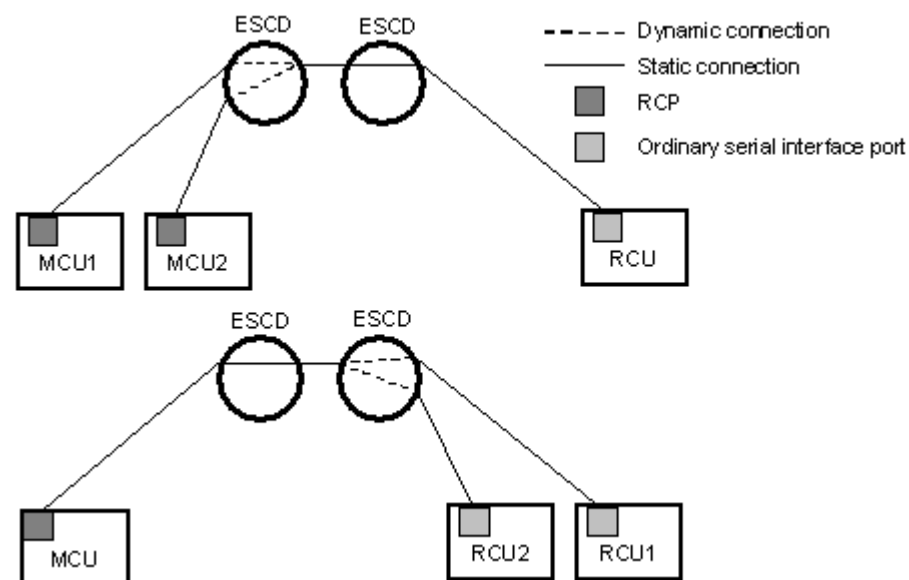


Figure 13 N-to-1 and 1-to-n remote copy connections ($n \leq 4$)



NOTE: 1-to-n configurations (one main disk array and multiple remote disk arrays) are valid for TC390A, as long as a consistency group does not span remote disk arrays.

In addition, the ESCDs can accommodate channel-to-MCU and channel-to-RCU connections in addition to the remote copy connections.

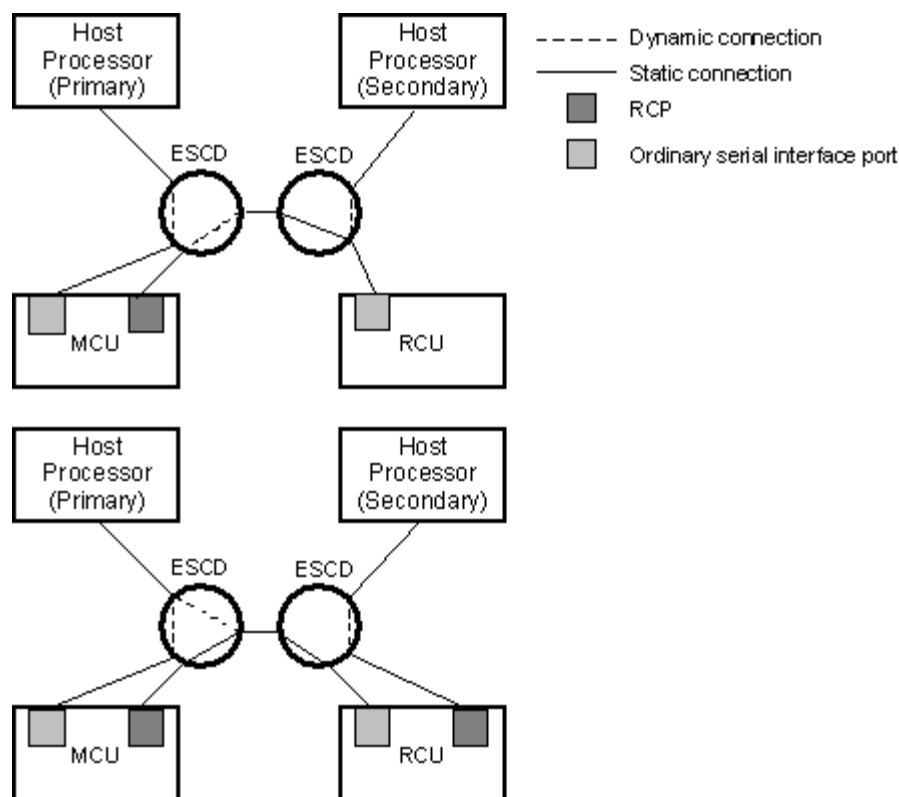


Figure 14 Remote copy connections shared with channel-to-RCU connections

Channel Extenders for Serial Remote Copy Connections

TC390A can be integrated with third-party channel extender products to provide remote data backup for distances greater than 43 km. Contact your HP account support representative for the latest information on channel extender support for TC390.

Installing the TrueCopy Software

The user installs the software required for TC390 operations on the Command View management station.

To install the TC390 software:

1. Install the Command View software on the Command View management station that is connected to the TC390 disk array(s).
2. Add each TC390 disk array to the Command View management station.
3. Enable the TC390 options on the Command View management station and on each TC390 disk array.

Configuring the MCUs and RCUs for TrueCopy Operations

After you have installed the TC390 hardware and software, you can configure the MCUs and RCUs for TC390 operations. The configuration depends on the interface type of the remote copy connections, serial or Fibre Channel.



NOTE: At this time serial interface and Fibre Channel interface configurations cannot coexist for the same MCU. Future support is planned.

Serial interface connection is not supported for this version.


Serial Interface Configuration

To configure the MCUs and RCUs for serial-interface TC390 operations:

1. Identify the volumes that will become the TC390 M-VOLs and R-VOLs. You need to know the disk array S/N, SSID, and CU image of each TC390 volume so that you can configure the MCUs and RCUs correctly for the appropriate pairs and async groups. When you create the pairs, you will need to know the port, group ID, and LUN of each volume.
2. Connect to the disk array that you want to configure as a TC390 MCU.



NOTE: You must operate the Command View management station in Modify mode to perform TC390 operations. Users in view mode can only view TC390 information.

3. From the Identity window, click the **Mainframe** tab, and then click the **TrueCopy** button () to start the TC390 software. The TrueCopy main window is displayed and the **Pair Operations** tab is displayed at the top.
4. Configure the serial interface ports that are connected to the RCUs as RCPs by the Port Change operation.
5. Register the RCU(s) to the current MCU CU image using the Add RCU window and set the options for the registering RCU using the RCU Option window. For additional instructions, see "[Registering an RCU \(Add RCU\)](#)" on page 93.
6. If you plan to create TC390A pairs with M-VOLs in this MCU, configure the MCU async options as shown in the following figure. For additional instructions, see "[Asynchronous Copy Option](#)" on page 112.

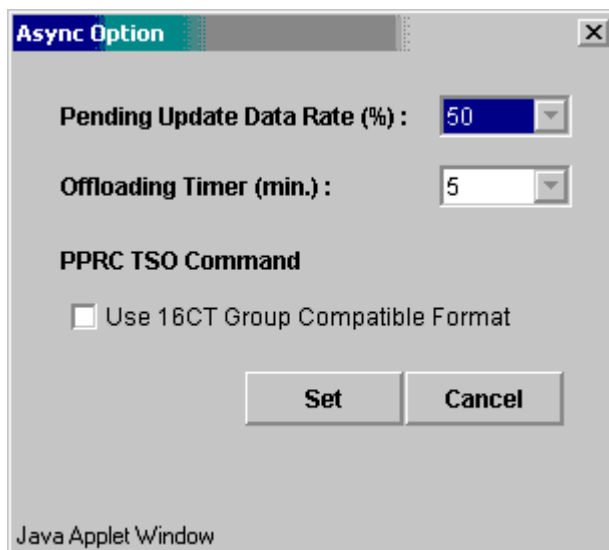


Figure 15 Setting the Async options

Then register the consistency group to the MCU as shown in the following figure. For additional instructions, see ["Adding Consistency Groups \(Add CT Group\)"](#) on page 109.

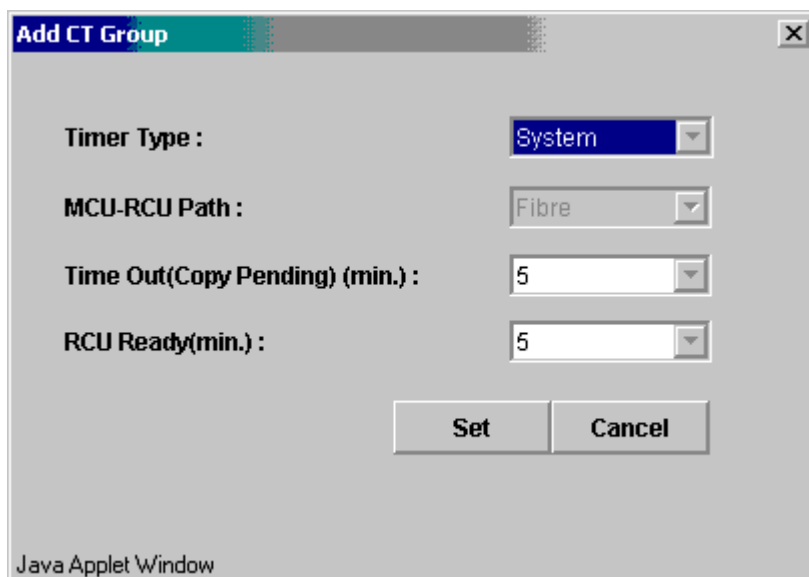


Figure 16 Adding the consistency groups

7. When you are finished configuring this MCU, exit the TrueCopy main window and close Command View.
8. Repeat [step 2](#) - [step 7](#) for each disk array that will function as a TC390 MCU. After you have configured the MCUs, registered the RCUs, and configured the TC390 Async options and consistency groups, you are ready to begin TC390 volume pair operations.


Fibre Channel Interface Configuration

To configure the MCUs and RCUs for TC390 Fibre Channel operations:

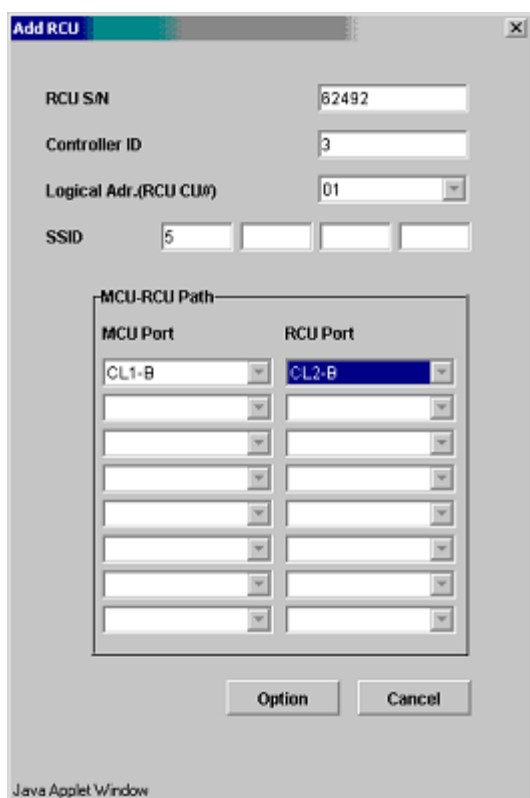
1. Identify the volumes that will become the TC390 M-VOLs and R-VOLs. You need to know the disk array S/N, SSID, and CU image of each TC390 volume so that you can configure the MCUs and RCUs correctly for the appropriate pairs and async groups. When you create the pairs, you will need to know the port, target ID, and LUN of each volume.
2. Connect to the disk array that you want to configure as a TC390 MCU.



NOTE: You must operate the Command View management station in Modify mode to perform TC390 operations. Users in view mode can only view TC390 information.

3. Click the **Mainframe** tab, and then click the **TrueCopy** button () to start the TC390 software. The TrueCopy main window is displayed and the **Pair Operations** tab is displayed at the top.
4. Configure the Fibre Channel interface ports that are connected to the RCUs as Initiators by the Port Change operation.

5. Register the RCU(s) to the current MCU CU image using the Add RCU window.

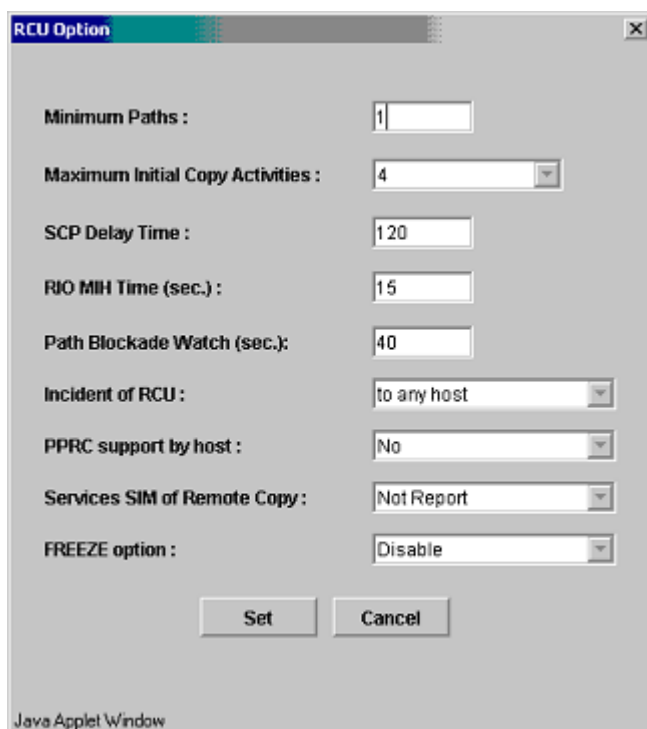


The 'Add RCU' window is a Java Applet Window with a title bar. It contains the following fields and controls:

- RCU S/N: Text box with value 62492
- Controller ID: Text box with value 3
- Logical Adr.(RCU CU#): Text box with value 01
- SSID: Text box with value 5
- MCU-RCU Path section:
 - MCU Port: List box with value CL1-B
 - RCU Port: List box with value CL2-B
 - Below these are two columns of empty list boxes for additional ports.
- Buttons: Option and Cancel

Figure 17 Add the RCUs

Set the options for the registering RCU using the RCU Option window as shown in the following figure. For additional instructions, see ["Registering an RCU \(Add RCU\)"](#) on page 93.



The 'RCU Option' window is a Java Applet Window with a title bar. It contains the following fields and controls:

- Minimum Paths : Text box with value 1
- Maximum Initial Copy Activities : List box with value 4
- SCP Delay Time : Text box with value 120
- RIO MIH Time (sec.) : Text box with value 15
- Path Blockade Watch (sec.): Text box with value 40
- Incident of RCU : List box with value to any host
- PPRC support by host : List box with value No
- Services SIM of Remote Copy : List box with value Not Report
- FREEZE option : List box with value Disable
- Buttons: Set and Cancel

Figure 18 Configuring the RCU options

6. If you plan to create TC390A pairs with M-VOLs in this MCU, configure the MCU async options as shown in the following figure. For additional instructions, see ["Asynchronous Copy Option"](#) on page 112.

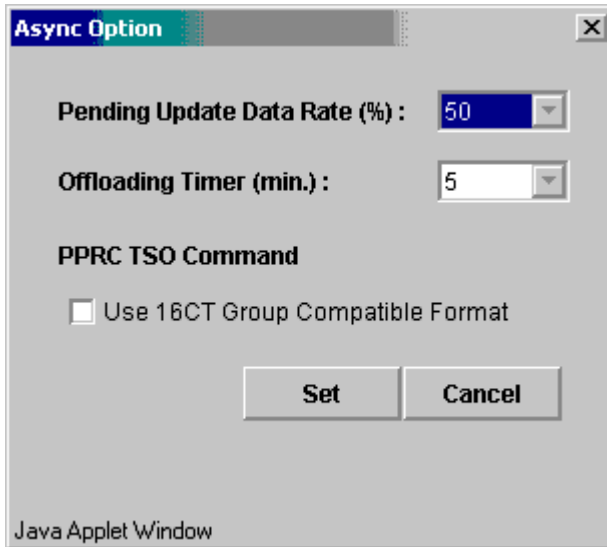


Figure 19 Setting the Async options

Then register the consistency group(s) to the MCU as shown in the following figure. For additional instructions, see ["Adding Consistency Groups \(Add CT Group\)"](#) on page 109.

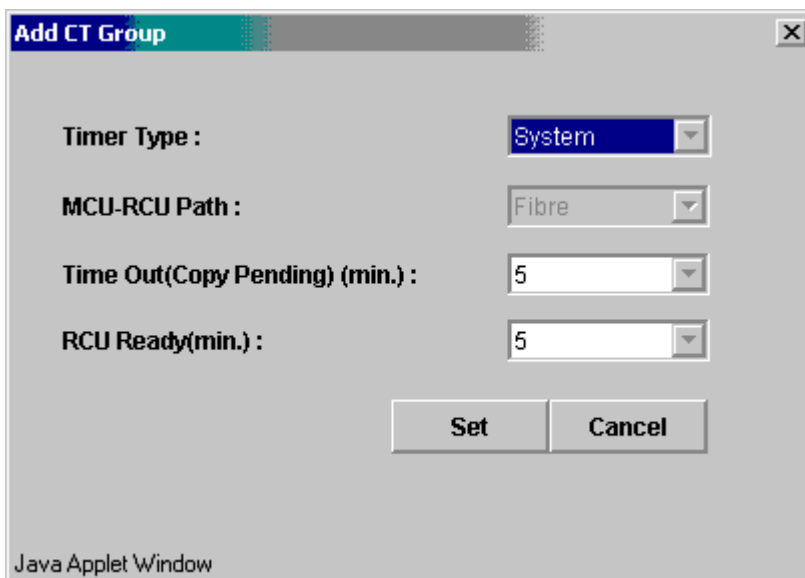


Figure 20 Adding the consistency groups

7. When you are finished configuring this MCU, exit the TrueCopy main window and close Command View.
8. Repeat [step 2](#) - [step 7](#) for each disk array that will function as a TC390 MCU. After you have configured the MCUs, registered the RCUs, and configured the TC390 Async options and consistency groups, you are ready to begin TC390 volume pair operations.

Combining TrueCopy with Other Data Management Operations

TC390 supports concurrent operations with the following data management functions:

- **Virtual LVI/LUN.** Virtual LVI/LUN volumes can be assigned to TC390 pairs as long as the R-VOL has the same or larger capacity than the M-VOL. If you need to perform Virtual LVI/LUN operations on an existing TC390 M-VOL or R-VOL, you must delete the pair first to return the volume to *simplex* status.
- **Cache LUN XP.** Cache LUN XP volumes can be assigned to TC390 pairs and Cache LUN XP operations can be performed on TC390 M-VOLs and R-VOLs.
- **SANtinel - S/390.** SANtinel operations do not affect TC390 operations. Secure volumes can be assigned to TC390 pairs, and TC390 volumes can be assigned to secure ports and/or groups for SANtinel operations.



NOTE: TC390 R-VOLs cannot be accessed by any host except when the pair is split.

- **HXRC.** The XP128/XP1024/XP12000 is functionally compatible with the IBM Extended Remote Copy (XRC) function. See [Table 13](#) on page 67.
- **SI390.** SI390 volumes can be assigned to TC390 pairs and TC390 volumes can be assigned to SI390 pairs. For information on TC390 and SI390 shared volume configurations, see "[Combining TrueCopy with Other Data Management Operations](#)" on page 66. This configuration requires at least one external ESCON or fibre cable loop.



NOTE: When TC390 and SI390 are both active on the same XP128/XP1024/XP12000, TC390 cannot be used to copy within that disk array. SI390 is recommended for disk array-internal copy. If SI390 is not active, TC390 Synchronous supports intra-disk array copy and requires at least one external ESCON cable loop.

- **Prioritized Port Control.** The initiator ports in the MCU do not support the Prioritized Port/WWN Control option because they are dedicated for TC390 operations.



NOTE: When TC390 and CA coexist in the same XP128/XP1024/XP12000, each consistency group must contain either TC390A pairs or CA Asynchronous pairs (not both), and TC390A and CA Asynchronous share the same cache sidefile area.

Combining TC390 and HXRC. The following table shows the requirements and restrictions for combining TC390 and HXRC operations on the same XP128/XP1024/XP12000 device.

Table 13 Requirements and restrictions for combining TrueCopy and HXRC

Combination allowed?	TC390 M-VOL	TC390 R-VOL	HXRC Primary	HXRC Secondary
TC390 M-VOL	--	No	Yes for TC390 Sync No for TC390 Async	Yes
TC390 R-VOL	No	--	No	No
HXRC Primary	Yes for TC390 Sync No for TC390 Async	No	--	Yes ¹
HXRC Secondary	Yes	No	Yes ¹	--

1. An XP128/XP1024/XP12000 volume that is an HXRC secondary device cannot also be an HXRC primary in the same XRC session, but it can be an HXRC primary device in another XRC session.

Combining TrueCopy and ShadowImage

TC390 and SI390 can be used together in the same disk array and on the same volumes to provide multiple copies of data at the main and/or remote sites. The following table describes the host pair status reporting for TC390 volumes, SI390 volumes, and TC390/SI390 shared volumes. [Table 15](#) on page 68 shows the currency of the data on a shared TC390/SI390 volume based on TC390 and SI390 pair status.

- For shared TC390/SI390 volumes, the TC390 pair status is reported to the host if you query the R-VOL. To obtain the SI390 pair status, query the target volume (T-VOL) of the pair.
- SI390 supports multiple target volumes (T-VOLs) for each source volume (S-VOL). If you issue a pair status query to an SI390 S-VOL (for example, CQUERY), the status for only one SI390 pair is reported (the pair with the T-VOL with the lowest LDEV ID). To obtain the pair status for the SI390 pair(s) with the other T-VOL(s), you must direct the host query to the specific T-VOL using the T-VOL's LDEV ID in the host command (for example, CQUERY DEVN parameter). SI390 through Command View displays the LDEV ID and SI390 pair status of all T-VOLs associated with an S-VOL.

Table 14 Host pair status reporting for TrueCopy/ShadowImage shared volumes

Number of TC390 Pairs	Number of SI390 T-VOLs	Pair Status Reported by XP128/XP1024/XP12000
0	0	Simplex
0	1	SI390 pair status
0	2 or more	ShadowImage pair status for the pair whose T-VOL has the lowest LDEV ID
1	0	TC390 pair status
1	1	TC390 pair status
1	2 or more	TC390 pair status

Table 15 Data currency of a shared TrueCopy/ShadowImage volume

TC390 Pair Status	ShadowImage Pair Status					
	Pending Duplex	Duplex	Split-Pending	Split	Resync	Suspended
Pending Duplex	Not current	Not current	Not current	CURRENT	Not current	Not current
Duplex	Not current	Not current	Not current	CURRENT	Not current	Not current
Suspended	Not current	CURRENT	CURRENT	CURRENT	CURRENT	Not current

The following figures show the various TC390/ShadowImage configurations that share volumes. TC390 supports synchronous and asynchronous operations for shared volumes. The following figure shows an example of a volume that is functioning as both a TC390 M-VOL and a ShadowImage S-VOL. With this configuration, you can:

- Use TC390 to provide remote backup copies of SI390 S-VOLs.

- Use SI390 to provide on-site backup copies of TC390 M-VOLs.

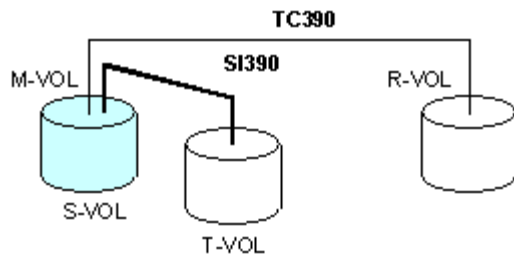


Figure 21 TrueCopy and ShadowImage: shared M-VOL/S-VOL

The following figure shows an example of a volume that is functioning as both a TC390 R-VOL and an SI390 S-VOL. With this configuration, you can use SI390 to provide additional remote copies of TC390 M-VOLs. This configuration is not allowed when At-Time Split is used on SI390.

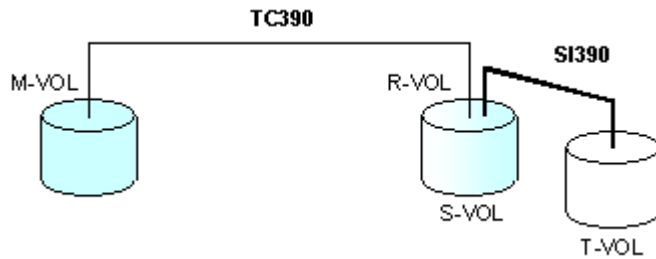


Figure 22 TrueCopy and ShadowImage: shared R-VOL/S-VOL

The following figure shows an example of a volume that is functioning as both a TC390 M-VOL and an SI390 S-VOL, while the R-VOL of the same TC390 pair is also functioning as the S-VOL of another SI390 pair. With this configuration, you can:

- Use TC390 to provide remote backup of SI390 S-VOLs.
- Use SI390 to provide on-site backup copies of TC390 M-VOLs and R-VOLs.

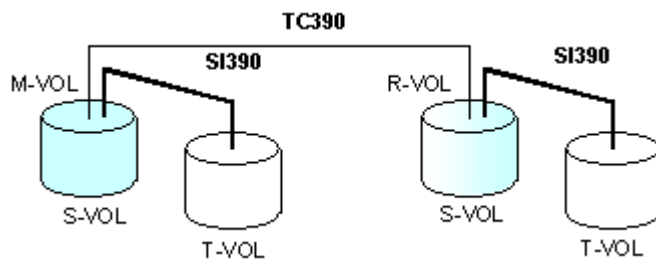


Figure 23 TrueCopy and ShadowImage: shared M-VOL/S-VOL and R-VOL/S-VOL

The following figure shows an example of a volume functioning as both a TC390 M-VOL and an SI390 T-VOL.



NOTE: This configuration does not allow SI390 and TC390 to copy at the same time. Create the SI390 pair first, and then split the pair before creating the TC390 pair. You must suspend the TC390 pair to resync the SI pair.

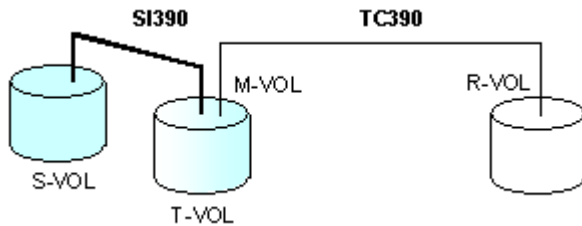


Figure 24 TrueCopy and ShadowImage: shared M-VOL/T-VOL

Starting TrueCopy

You must operate the Command View management station in Modify mode to perform TC390 operations. Users in view mode can only view TC390 information.

To access TC390:

1. From the Launch window, click an XP128, XP1024, or XP12000.
2. Click the **Mainframe** tab, and then click the **TrueCopy** button (). The TrueCopy main window is displayed and the **Pair Operations** tab is displayed at the top.



NOTE: The storage partition administrator cannot perform TrueCopy for z/OS operations.

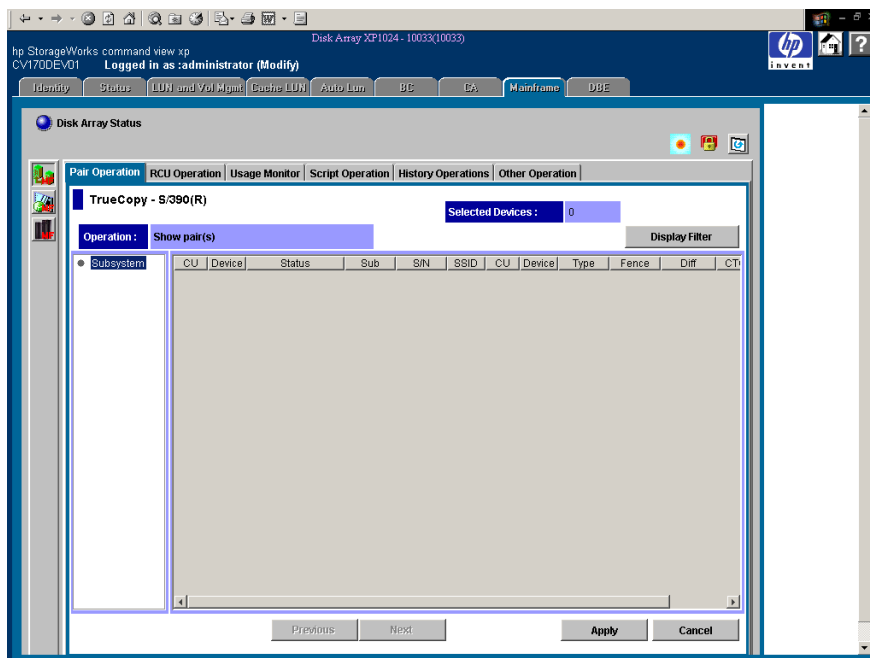


Figure 25 TrueCopy main window



CAUTION: Do not perform TC390 operations using the TrueCopy main window while the TC390 scripting function is being executed. To perform TC390 operations on the TrueCopy main window, wait until the script is complete or verify that the script in execution is aborted.

Performing TrueCopy Configuration Operations

The TC390 configuration operations include the MCU operations, RCU operations, TC390A control operations, discontinuing TC390 operations, and scripting. The TrueCopy main window (see page 72) provides access to all TC390 configuration operations.

RCU operations. The RCU operations (see "[RCU Operations](#)" on page 88) configure the RCUs for TC390 operations:

- Configuring host interface ports for MCU-RCU connection
- Adding the RCUs
- Setting the RCU options
- Adding/deleting logical paths to an RCU
- Adding/deleting SSIDs for an RCU
- Viewing RCU status
- Deleting RCUs

Asynchronous operations. The TC390A control operations (see "[Asynchronous Operations](#)" on page 106) configure the TC390A groups and options:

- Setting the async options
- Adding consistency group
- Viewing consistency group status
- Changing the consistency group options
- Changing the async options
- Deleting consistency groups

Usage Monitor operations. Use the usage monitor operations (see page 114) to collect the I/O statistics for the LDEVs on the disk array.

Script operations. Use the scripting function to specify and execute a series of TC390 operations without having to issue commands separately (see "[Script Operations](#)" on page 118).

History operations. Use the history operations (see "[History Operations](#)" on page 118) to export the remote copy history file.

Other operations. The other operations (see "[Other Operations](#)" on page 118) include clearing SIMs.

You can optimize TC390 operations and XP128/XP1024/XP12000 performance by selecting the TC390 settings and options for your operational environment and also by addressing conditions that can affect disk array performance. For more information, see "[Optimizing TrueCopy Operations and Disk Array Performance](#)" on page 118.

To discontinue TC390 operations, perform the required TC390 operations (for example, pair deletion, RCU deletion, port reconfiguration, and so forth) in a specific order to ensure smooth operations and

avoid command rejects and error conditions. For more information, see “[Discontinuing TrueCopy Operations](#)” on page 119.

TrueCopy Main Window

To access any of the TrueCopy windows, click one of the following tabs: **Pair Operations**, **RCU Operations**, **Asynchronous Operations**, **Usage Monitor**, **Script Operations**, **History Operations**, and **Other Operations** tabs.

The TrueCopy main window (also known as the Pair Operations window) is displayed by clicking the **Pair Operations** tab. This window shows the information for the selected CU image of the connected disk array and provides access to all TC390 functions.

The following table shows the TC390 functions of each tab. The function menus can be displayed by right-clicking the list. To apply the settings you made on the TC390 function tabs, click **Apply**.

Table 16 TC390 functions

Tab	Menu Command	Description
Pair Operations	Pair Status	Displays the CU information, path information, pair status, and settings information of the TC390 pairs.
	Add Pair > Synchronous	Sets new TC390 Synchronous pairs.
	Add Pair > Asynchronous	Sets new TC390A pairs.
	Delete Pair	Deletes the TC390 pairs that are already set.
	Suspend Pair	Suspends the TC390 pairs.
	Resume Pair	Resumes the TC390 pairs that are suspended.
	Change Pair Option	Modifies the pair options that are originally set (Fence level or Error level).
	Snapshot	Create the new snapshot file.

Table 16 TC390 functions (continued)


Tab	Menu Command	Description
RCU Operations	RCU Status	Displays the RCU status and TC390 port numbers that are already set.
	RCU Operation > Add RCU	Registers the RCU at the remote disk array. RCU controls the R-VOL of the TC390 volume pair.
	RCU Operation > Delete RCU	Deletes the RCU that is already registered.
	RCU Operation > Change RCU Option	Modifies the options for RCUs that are already registered.
	Edit SSID(s) & Path(s) > Add Path	Adds the paths to RCUs.
	Edit SSID(s) & Path(s) > Delete Path	Deletes the paths to RCUs.
	Edit SSID(s) & Path(s) > Add SSID	Adds the SSIDs of RCUs that are connected to MCU.
	Edit SSID(s) & Path(s) > Delete SSID	Deletes the SSIDs of RCUs that are already connected to MCU.
	Port	Sets or changes the port type at the MCU (Target, RCU Target or Initiator).
Asynchronous Operations	Async Option	Sets and modifies the asynchronous copy options.
	CT Group Operation > CT Group Status	Displays the information of the consistency groups that are already registered.
	CT Group Operation > Add CT Group	Assigns the CUs to the consistency groups.
	CT Group Operation > CT Group Option	Modifies the settings for the consistency groups that are already assigned.
	CT Group Operation > Delete CT Group	Deletes the consistency groups that are already assigned.
Usage Monitor	-	Obtains the I/O statistics using the Remote Copy Monitoring function.
Script Operations	-	Uses the script function.
History Operations	-	Displays the operation history of TC390 volume pairs.
Other Operations	Clear SIM	Clears all the remote copy SIMs.

The following sections describe the configuration of each tab and how to use the tabs to operate the TC390 functions (see “[Performing TrueCopy Pair Operations](#)” on page 120 for TC390 volume pair configuration).

TrueCopy Main Window (Pair Operations Window)

The first window that is displayed after clicking the **TrueCopy** button is the TrueCopy main window, also known as the Pair Operations window. To display this window at any time, click the **Pair Operations** tab from any of the other TrueCopy windows.

The TrueCopy main window displays information for the selected CU image of the connected disk array. From this window, you can configure the volume pairs. This section describes the components of the TrueCopy main window. For the information about the TC390 volume pair configuration, see “[Performing TrueCopy Pair Operations](#)” on page 120.

Information displayed on the TrueCopy main window is updated when the TrueCopy main window is opened, when the tab is switched from one to another, and when the **Refresh** button () is clicked.

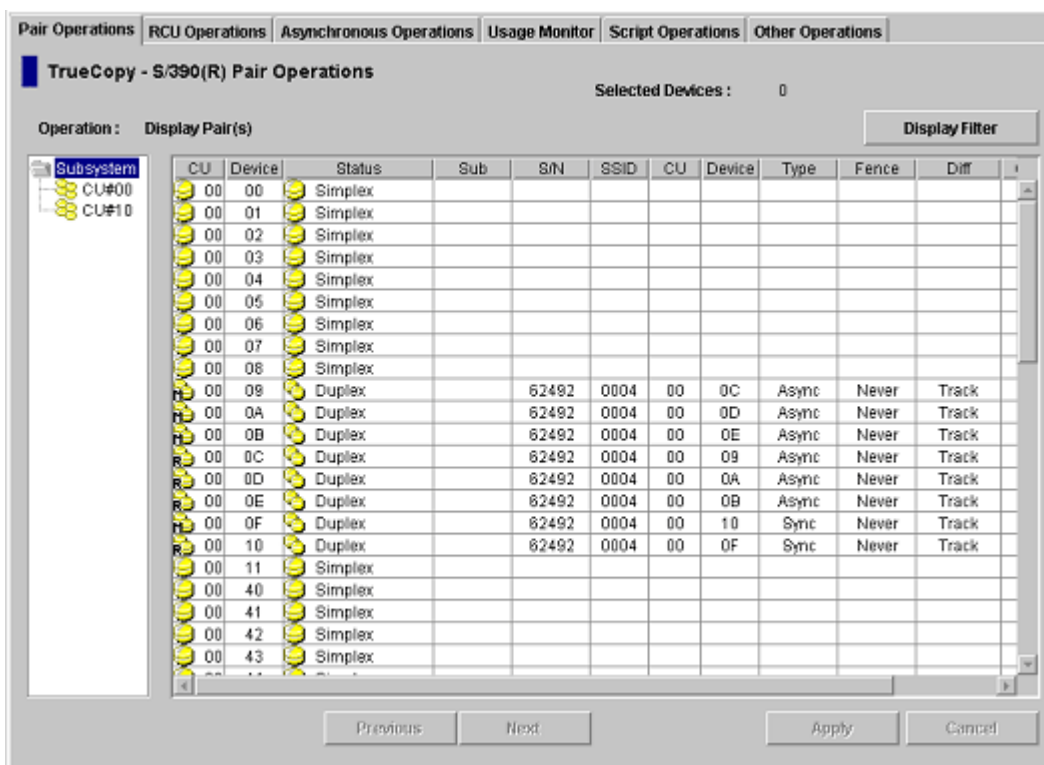



Figure 26 TrueCopy main window (Pair Operations window)

The TrueCopy main window consists of the CU Number tree, the Volume list (see “[Volume List](#)” on page 75), the **Display Filter** button (see “[Display Filter](#)” on page 76), and the **Previous/Next** button.

Subsystem is selected on the CU Number tree when you first open the TrueCopy main window. Under Subsystem, there are branches of the CU numbers (). Only the CU, which contain the available volumes, are shown in the CU Number tree. A CU number can be selected in the CU Number tree to specify the information displayed in the Volume list. More than one CU number cannot be selected.

The **Volume** list displays information for each volume of the connected disk array (see “[Volume List](#)” on page 75). The information displayed in this list is sorted in the order of the Device number by default. The information for the volumes, which are defined for several paths, are displayed in several rows as many as the path defined.

The **Display Filter** button opens the Display Filter window (see “[Display Filter](#)” on page 76), which you can use to select the volumes displayed on the Volume list. The volumes can be selected specifying pair status, pair type, and group number.

In the Volume list, eight to twelve rows of volume information are displayed at once. The 256 rows can be displayed using the scroll bar. The **Previous/Next** buttons switches the Volume list to the previous or next 256 rows.

Volume List

The Volume list displays the following information for each volume of the connected disk array. The information displayed in this list is sorted in the order of the Port number by default. Each item can be sorted in ascending order or descending order. To sort the items, click the head of the list (for example, Device or Status). Not all of the items of the Volume list can be displayed at once. To see all the items of the list, use the scroll bar below the Volume list.






NOTE: To change the number of items that can be displayed without scrolling, change the font size.

CU	Device	Status	Sub	S/N	SSID	CU	Device	Type	Fence	Diff	CTG	ErrLvl
00	00	Simplex										
00	01	Simplex										
00	02	Simplex										
00	03	Simplex										
00	04	Simplex										
00	05	Simplex										
00	06	Simplex										
00	07	Simplex										
00	08	Simplex										
00	09	Duplex		62492	0004	00	0C	Async	Never	Track	00	Group
00	0A	Duplex		62492	0004	00	0D	Async	Never	Track	00	Group
00	0B	Duplex		62492	0004	00	0E	Async	Never	Track	00	Group
00	0C	Duplex		62492	0004	00	09	Async	Never	Track	00	Group
00	0D	Duplex		62492	0004	00	0A	Async	Never	Track	00	Group
00	0E	Duplex		62492	0004	00	0B	Async	Never	Track	00	Group
00	0F	Duplex		62492	0004	00	10	Sync	Never	Track		
00	10	Duplex		62492	0004	00	0F	Sync	Never	Track		
00	11	Simplex										
00	40	Simplex										
00	41	Simplex										
00	42	Simplex										

Figure 27 Volume list

- **Volume icon:** Indicates the status of volumes.
 - : Simplex
 - : M-VOL
 - : R-VOL
- **CU:** CU number of the main LDEV.
- **Device:** Device number.
- **Status:** For more information on TC390 pair status, see ["TrueCopy Volume Pair Status"](#) on page 46.
 - : **Simplex.** The volume is not currently assigned to a TC390 pair. When the initial copy is started by an Add pair operation, the volume status changes to *Pending*.
 - : **Pending.** The TC390 initial copy operation is in progress. Data on the pair is not fully identical. When the initial copy is complete, the status will change to *Duplex*.
 - : **Duplex.** The volume is currently assigned to a TC390 pair and the pair is 100% synchronized. All updates from the host to the M-VOL are duplicated at the R-VOL.

- : **Suspending.** The TC390A pair is being suspended. When the TC390A suspend operation is complete, *suspending* changes to *suspended*.
- : **Suspend.** The TC390 pair has been suspended. Open the Pair Status window to view the suspend type (see "[TrueCopy Volume Pair Status](#)" on page 46) and detailed pair status information.
- : **Deleting.** TC390A only. This pair is not synchronized. This pair is in transition from the *Duplex*, *Pending duplex*, or *Suspend* state to the *Simplex* state.
- **Sub:** Suspend Sub Status
 - **GRP:** Consistency time of the current volume is same as that of the consistency group.
 - **VOL:** Consistency time of the current volume is not same as that of the consistency group.
 - **OFF:** Suspended by the PS OFF by the MCU.
- **S/N** and **SSID** of the other disk array (MCU or RCU) of the volume pair.
- **CU** number of the other volume of the volume pair.
- **Device** number of the other volume of the volume pair.
- **Type:** Pair mode, Synchronous or Asynchronous.
- **Fence:** The M-VOL fence level of the TC390 volume pair: data, status, or never. For a complete description of the TC390 M-VOL fence-level parameter, see "[Creating TrueCopy Volume Pairs \(Add Pair\)](#)" on page 126.
- **Diff:** The information about the differential data.
- **CTG:** Consistency Group number of the pair (only for the Asynchronous pairs).
- **ErrLvl:** Error level of the pair (only for the Asynchronous pairs).
 - **Group:** When the specified pair is suspended, all TC390A pairs in the same consistency group will be suspended, even if the failure affects only that pair and not the entire group.
 - **Volume:** If the failure affects only the specified pair, then only that pair will be suspended. A failure that affects an entire group will always result in the suspension of all pairs in the group, as well as all other affected TC390 pairs.
- **CLPR:** The number and name of the CLPR to which the volumes forming pairs belong. For more information about CLPRs, see the *HP StorageWorks Command View XP for XP Disk Arrays User Guide*.

Select the **Group** error level for all TC390A volumes that are essential to disaster recovery. Do not use suspended TC390A R-VOLs that have the **Volume** error level for disaster recovery.



NOTE: The **S/N**, **SSID**, and **Fence** columns might be blank while the pair is in transition from a pair status to Simplex. To display the latest information in these columns, refresh the window.

Volumes that are currently assigned to SI390 pairs are displayed in the Volume list as simplex. The user is responsible for managing volumes assigned to SI390 and HXRC pairs.

Display Filter

The **Display Filter** button opens the Display Filter window. Use the Display Filter window to select which volumes to be displayed on the Volume list. You can select the CU number, Consistency group number, Pair type, Volume type, Copy type and Pair status.

When you select the CU number on the CU Number tree, the selection in the CU Number tree has precedence over the specification in the Display Filter window. When the CU number is selected in the tree, the specification on the Display Filter window for the CU number is not available. To make all the settings on the Display Filter window available, select **Subsystem** in the **CU Number** view. The Display Filter settings are available while you are operating the TC390 software until you reset the settings.



NOTE: You cannot use other windows without closing the Display Filter window.

Figure 28 Display Filter window

Use the **CU#** list to specify the number of the CU to be displayed.

Use the **CT Group** list to specify the number of the consistency group to be displayed. This specification is available only for the Asynchronous pair.

Use the **Type** list to specify the pair type, synchronous or asynchronous.

Use the **M-VOL/R-VOL** list to specify the Volume type, M-VOL or R-VOL.

Use the **MCU-RCU Path** list to specify the channel type (Fibre).

Use **CLPR** to select the CLPR (or all CLPRs).

Use the **Status** check boxes to display only volumes that have the selected pair status: **Simplex**, **Pending**, **Duplex**, **Suspend**, **Suspending** (async only), and/or **Deleting** (async only). The Simplex volumes are always displayed otherwise the **SEQ[SEQCHK]Only** check box is selected.

Use the **Sub Status** check boxes to select the consistency status of the Asynchronous pairs.

Use the **SEQ[SEQCHK]Only** check box to display only the TC390A pairs that are in the SEQCHK status. When this check box is selected, TC390 Synchronous and Simplex volumes are not displayed.

The **Reset** button clears your specifications and displays the default settings. All of the lists become **ALL**. The **Set** button applies your specifications to the Volume list and closes the Display Filter window.

Snapshot Function

The TC390 snapshot function reports the user-selected TC390 pair status information. The reported status information is determined by your selections in the Display Filter window.



NOTE: If # is added to the end of an LDEV number, such as **3F#**, the LDEV is an external volume. For more information about external volumes, see "[HPAV for the XP128/XP1024/XP12000](#)" on page 351.

To create a TC390 snapshot file:

1. Click **Display Filter** to display the Display Filter window.
2. Select the options you want in the Display Filter window and close the window.
3. From the Pair Operations window, right-click to display the pop-up menu and click **Snapshot**. A confirmation dialog box is displayed.
4. Click **OK** to create the snapshot file.



NOTE: If a snapshot file already exists, the new snapshot file data will overwrite the existing snapshot file.

An example of snapshot file is shown in the following figure.


<Pair status at 05/10/2002 20:22:12>													
Vol	Status	Sub	S/N	SSID	Vol	Type	Fence	Diff	CTG	EL	Prio	Sync	CLPR
00:00	Simplex					:							00:CLPRO
00:01	Duplex		12345	0001	1F:1E	Sync(M)	Data	Cylinder			032	100	01:CLPR1
00:02	Suspend	GRP	12345	0001	1F:1D	Asyn(R)	Never	Cylinder	0C	GRP	032	050	02:CLPR2

Figure 29 Example of snapshot file

RCU Operations Window

Clicking the **RCU Operations** tab displays the RCU Operations window, which shows the RCU information and provides access to the TC390 RCU setting operations (see "[RCU Operations](#)" on page 88).

The RCU Operations window consists of the **Display** buttons, the Operation information, the CU number/Port tree, the MCU/RCU list (see "[CU Number Tree and MCU/RCU List](#)" on page 79), and the Port list (see "[Port Tree and Port List](#)" on page 81). MCU/RCU list is displayed by default.

The RCU Operations window is updated when the tab is switched from one to another, when the **Refresh** button () is clicked, and when the settings for the RCU are applied. For the RCU settings operation, see “RCU Operations” on page 88.

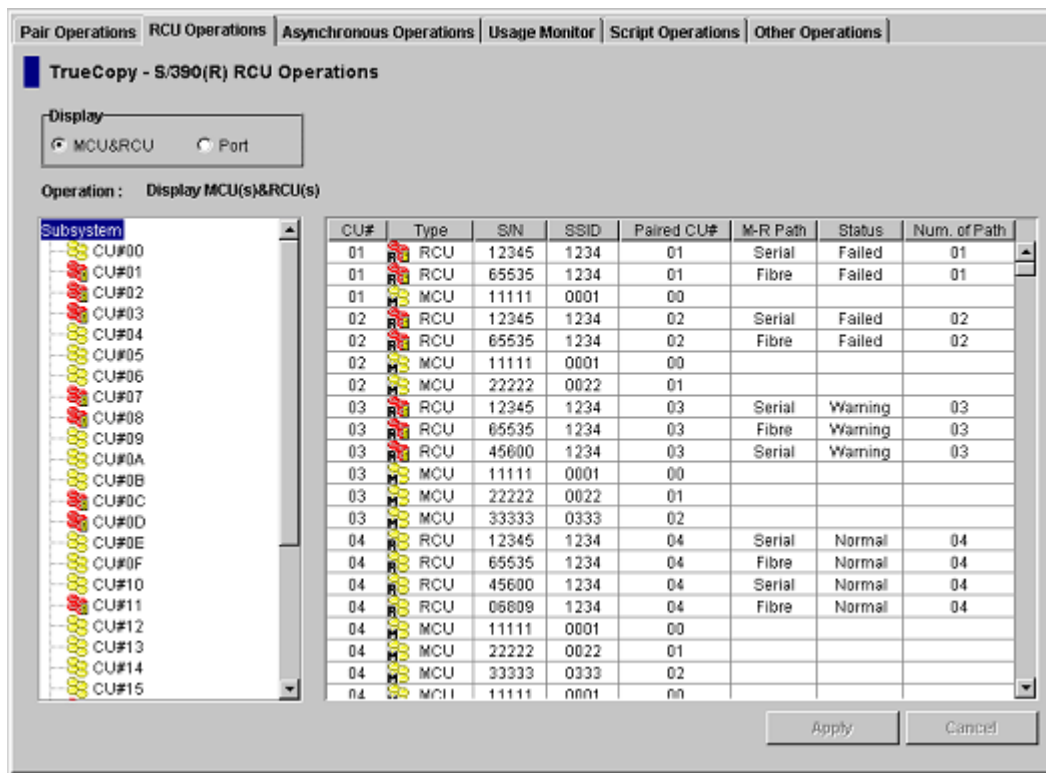



Figure 30 RCU Operations window

The **Display** buttons switch the contents of the tree and the list. Clicking **MCU&RCU** displays the CU Number tree and the MCU/RCU list (see “CU Number Tree and MCU/RCU List” on page 79). Clicking **Port** displays the Port tree and the Port list (see “Port Tree and Port List” on page 81).

The **Operation** information indicates the current operation performed on the RCU Operations window.

CU Number Tree and MCU/RCU List

The CU Number tree and the MCU/RCU list are displayed when the **MCU&RCU** option is selected in the Display box. In the CU Number tree, only the CU numbers, which include active MCUs or RCUs, are displayed. There is no branch under the CU Number tree. When the CU contains RCU that has the failed path, the error icon () is shown for the CU number in the CU Number tree.

In the CU Number tree, the CU number can be selected to display the specified information in the MCU/RCU list. You can select only one CU number on the CU Number tree.

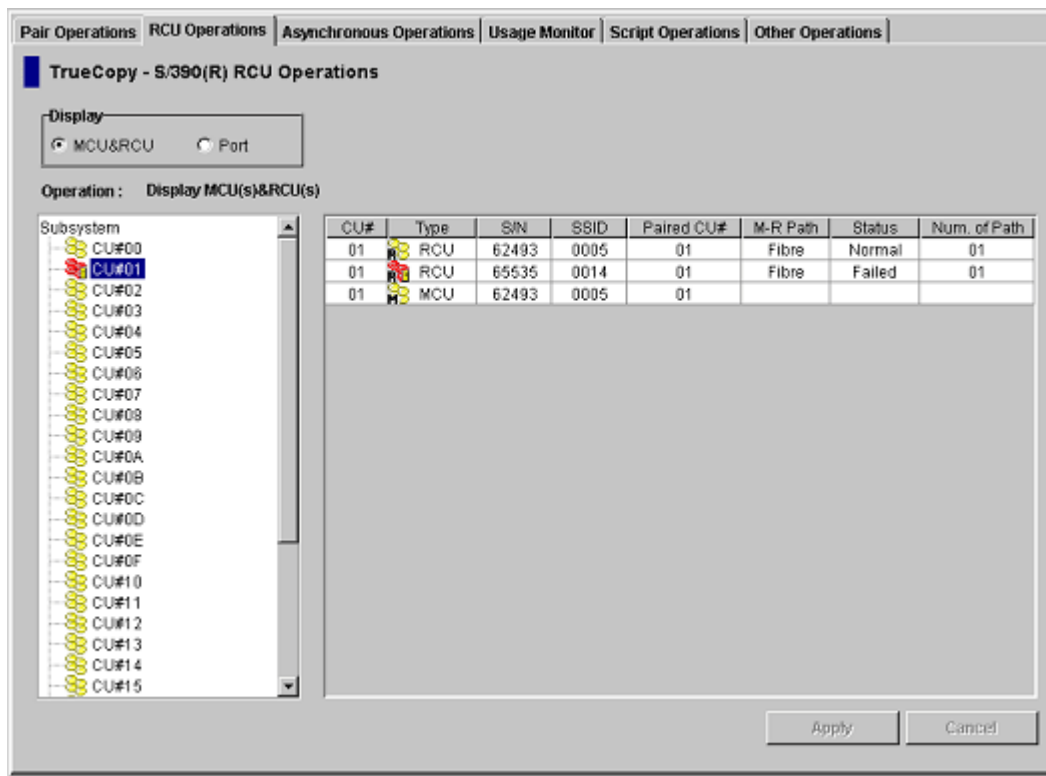


Figure 31 RCU Operations window with the MCU&RCU option button selected

- **CU#:** CU number that is selected on the tree.
- **Type:** MCU (MCU icon) or RCU (RCU icon).
- **S/N** and **SSID:** Serial number and SSID of the other CU of the pair.
- **Paired CU#:** CU number of the other CU of the pair.
- **M-R Path:** Path channel type (Fibre or Serial) between the other CU of the pair.
- **Status:** **Normal** indicates no failure path between the RCU. **Failed** indicates that there is failure paths between the RCU. This column is blank when the pair CU is MCU.
- **Num. of Path:** Number of paths (is blank when the pair CU is MCU).

Port Tree and Port List

Clicking **Port** in the Display box displays Port tree and the Port list. The Port tree displays the channel adapters and the port types. Only the ports that are installed and can be selected for remote copy operations are displayed.

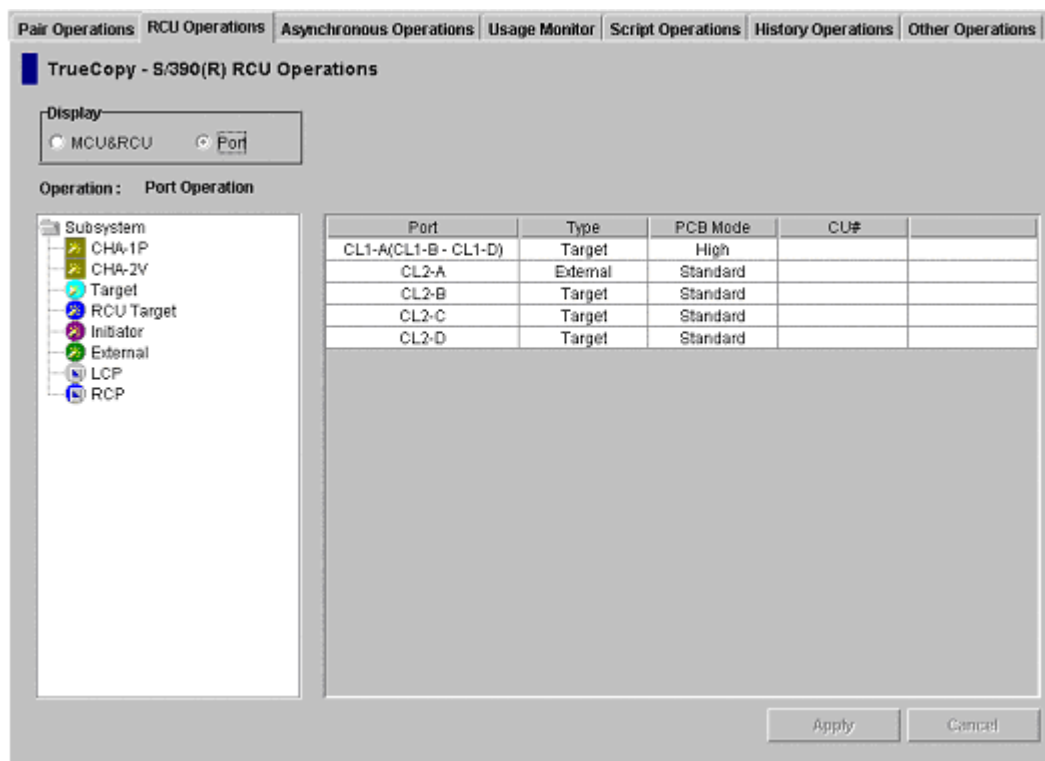


Figure 32 RCU Operations window with the Port option button selected

- **Port:** Cluster and port number (CL1-A to CL2-R).
- **Type:** Port type (Initiator, Target, RCU Target, External, RCP, or LCP).
- **PCB Mode:** Speed mode of the port, only for the Fibre ports (standard, high-speed, or high-speed (2 port)).
- **CU#:** Range of CU images: 16 CU: 00-0F (00 through 0F), 10-1F (10 through 1F).



NOTE: High-speed (2 port) mode is available only if the XP disk array has firmware version 21.06.22 or later installed.

The port information in each row depends on the type of channel adapter.

- 1 port in one row (standard).
- 2 ports in one row (standard).
- 2 ports per row (high-speed, 2 port).

- 4 ports in one row (high-speed).

Port	Type	PCB Mode	CU#	
CL2-E,CL2-F	Initiator	Standard		
CL2-G,CL2-H	RCU Target	Standard		

Figure 33 Standard speed, two ports per row

Port	Type	PCB Mode	CU#	
CL1-E(CL1-F)	Target	High(2Port)		

Figure 34 High-speed (2 port), two ports per row

Port	Type	PCB Mode	CU#	
CL1-E(CL1-F - CL1-H)	Initiator	High		

Figure 35 High-speed, four ports per row

In the Port tree, the port type can be selected to display the specified information in the Port list. For example, when **RCU Target** is selected in the Port tree, the system looks for ports of Initiator from all the ports entered and lists the RCU Target ports in the Port list as shown in the following figure. Only one Port type can be selected in the tree.

Asynchronous Operations Window

Clicking the **Asynchronous Operations** tab displays the Asynchronous Operations window, which shows the consistency group information for the connected disk array and provides access to the TC390A pair operations (see "[Asynchronous Operations](#)" on page 106).

The Asynchronous Operations window consists of the information about the SideFile and the information about the consistency group that is displayed in the Consistency Group tree and the Consistency Group list.

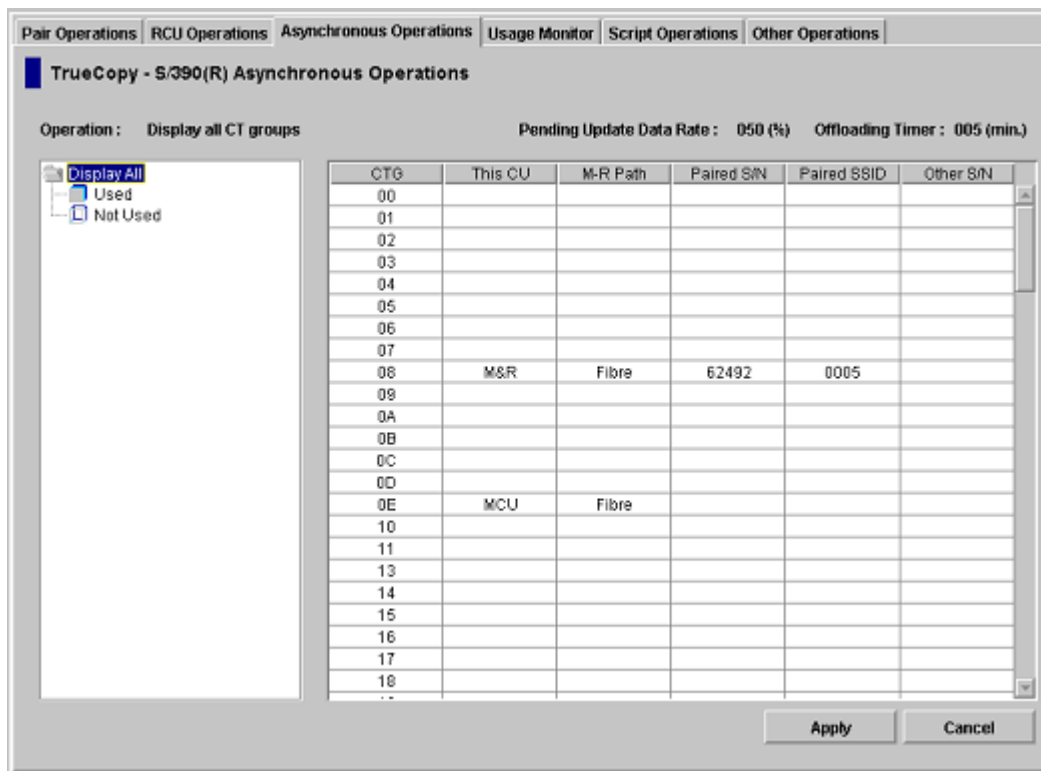




Figure 36 Asynchronous Operations window

The **Operation** information indicates the current operation performed on the Asynchronous Operations window.

Pending Update Data Rate is always displayed and shows the maximum cache % available for use by TC390 Async sidefiles.

Offloading Timer indicates the maximum time between TC390 Async recordset transfers.

Display All is selected in the Consistency Group tree when the Asynchronous Operations window is displayed. All consistency groups (00-7F) are listed in the Consistency Group list. When **Used** () of Consistency Group tree is selected, the consistency groups that are already registered are listed in the Consistency Group list. When **Not Used** () of Consistency Group tree is selected, the consistency groups that are not registered are listed.

Consistency Group list consists of the following items:

- **CTG**: Consistency group number.
- **This CU**: The CU that initially registered the consistency group. When the consistency group is not registered, the column is blank. **MCU**: The local CU registered the consistency group. **RCU**: The consistency group is registered from the paired CU (the local CU is RCU). **M&R**: MCU and RCU are in the same disk array.
- **M-R Path**: Channel type, Fibre or Serial. When the consistency group is not registered, the column is blank.
- **Paired S/N**: Serial number of the paired disk array (the disk array with the lowest serial number). When the consistency group is not registered, the column is blank.
- **Paired SSID**: SSID (Storage subsystem ID) of paired disk array (the disk array with the lowest SSID). When the consistency group is not registered, the column is blank.

- **Other S/N: Exist:** indicates that there are RCU other than the one with the lowest serial number. When there is no other RCU, the column is blank.

Usage Monitor Window

Click the **Usage Monitor** tab to display the Usage Monitor window and perform the Remote Copy Monitoring function. The Remote Copy Monitoring function obtains the I/O statistics for all the LDEVs on the connected disk array.



NOTE: You must operate Command View in Modify mode to perform TC390 operations. Users in view mode can only view TC390 information.

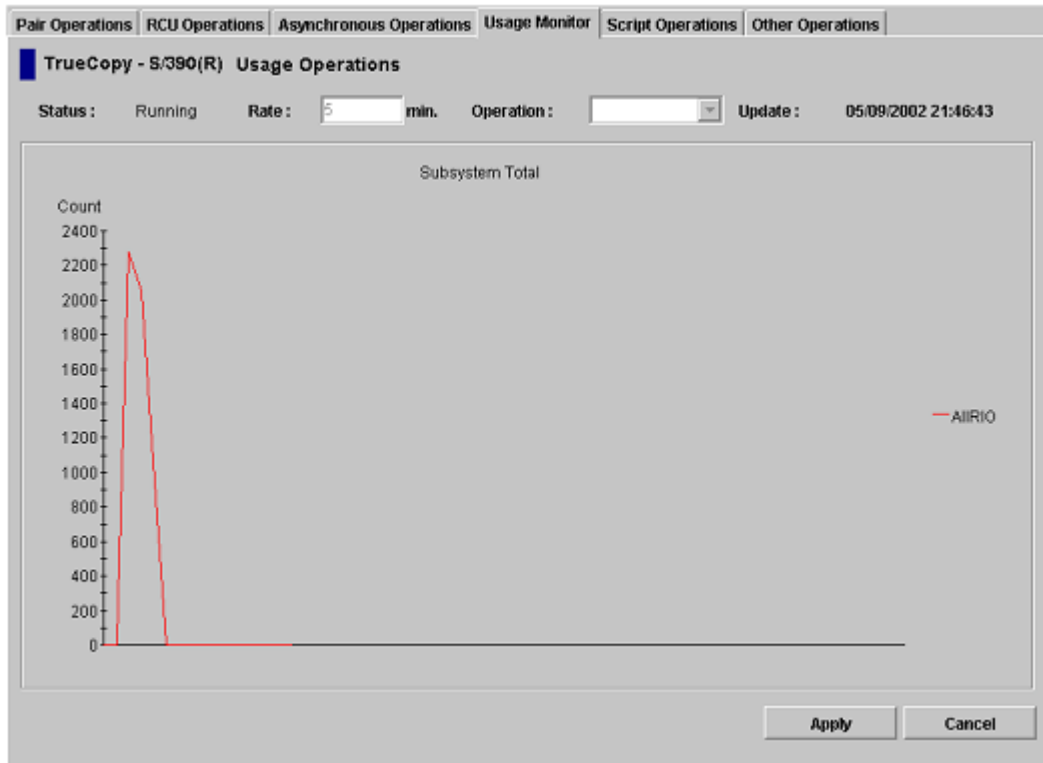


Figure 37 Usage Monitor window

The Usage Monitor window displays the following information:

- **Status:** Displays **Running** when monitoring is on and displays **Stop** when monitoring is off. When monitoring is stopped, the usage monitor graph is closed. The usage monitor graph can only be displayed when monitoring is running.
- **Rate:** Displays the data collection rate for usage monitoring (default = 5). When monitoring is stopped, the default value (5) is displayed in the Rate box.
- **Operation:** Used to select the usage monitor operation.
- **Update:** Displays the most recent data sample time of the data on the graph.

Script Operations Window

TC390 running on Command View supports scripting for managing pre-defined TC390 operations. The TC390 scripting function defines multiple TC390 operations in a text file that Command View reads and executes as a batch file. Use the scripting function to perform a series of TC390 operations without having to issue the commands separately. Using TC390 scripting, you can set up and execute a large number of TC390 commands within a short period of time. Use the TC390 scripting function to:

- Save time by executing multiple TC390 operations with a single command.
- Run a series of predefined and tested TC390 operations after hours or overnight.
- Allow a non-resident system administrator to set up and start an entire day's worth of TC390 operations in the limited time that the administrator is on-site.

This section describes the selection and execution of an existing TC390 script file. "TrueCopy Scripting" on page 195 describes and specifies the requirements for the TC390 script files.



CAUTION: Do not perform TC390 operations using the Pair Operations window while the scripting function is being executed. To perform TC390 operations on the Pair Operations window, wait until the script is complete, or verify that the script in execution is aborted.



NOTE: The script file must be transferred to the SVP before executing the script.

Clicking the **Script Operations** tab displays the Script Operations window, which shows information for the script being executed.

At this time, exporting script trace files is not supported.

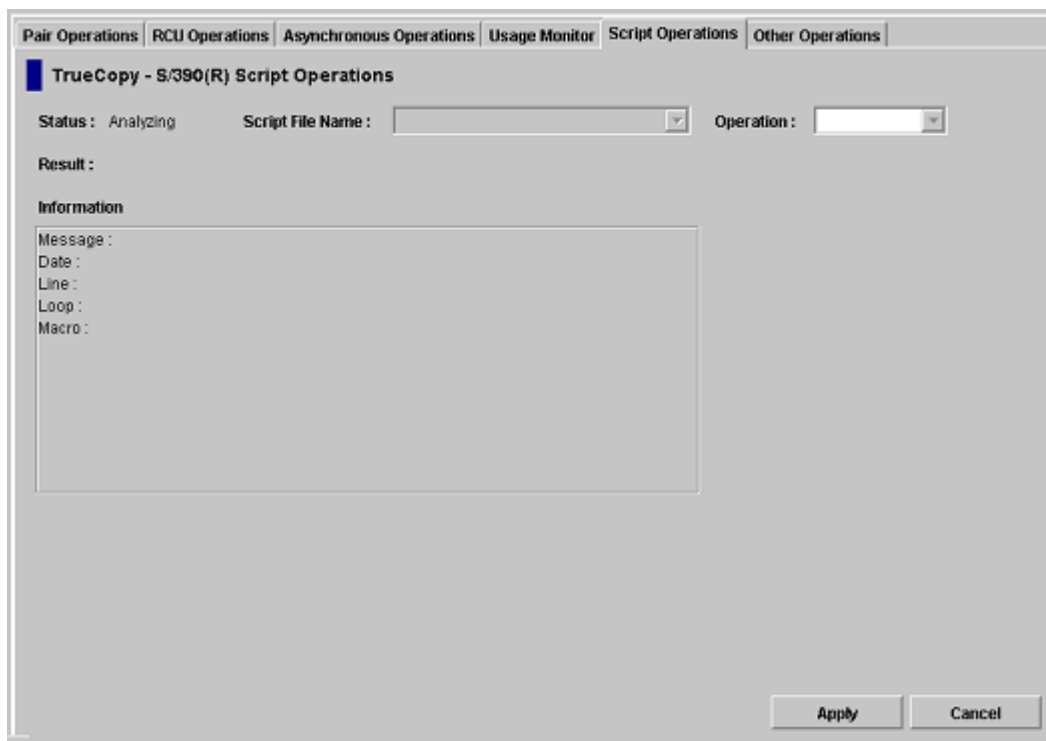


Figure 38 Script Operations window

The **Status** box displays the status of the script execution.

- **Stop:** The script has not been executed yet or the script execution has been completed.
- **Analyzing:** The script analysis operation is running.
- **Running:** The script is running.

In the **Script File Name** box, select the name of the TC390 script file.

In the **Operation** box, select a command. TC390 software operation mode must be the Modify mode.

- **Run:** Run the TC390 script file that is selected in the **Script File Name** box. If the script file is in the running status, **Run** cannot be selected.
- **Stop:** Stop the TC390 script file that is running. The script operation is stopped on the script line basis. If the script file execution has been completed, **Stop** cannot be selected.

To check the status of the script file, click the **Refresh** button (). The information of the **Status** box is updated.

The **Result** box displays the error code in four-digit hexadecimal number.

The **Information** boxes displays the script information.

- **Message:** The message is displayed when the script operation has been completed. **Normal End** indicates that the operation completed normally. When the script is ended abnormally because of the error in the script file, the message, which indicates the abnormal end, is displayed. When the script is stopped by the **Stop** command, **Abort by operator** is displayed.
- **Date:** The date when the script status changed.
- **Line:** The script file line number being executed.
- **Loop:** The current/total repetition count for a looped command (for example, 150/300).
- **Macro:** The macro being executed. Macros that execute a process for a device are listed: CreateHrcPair, ChangeHrcPair, SuspendHrcPair, ResumeHrcPair, and DeleteHrcPair.

The following figure shows the example of the **Script Operations** tab during the execution of a Script File.

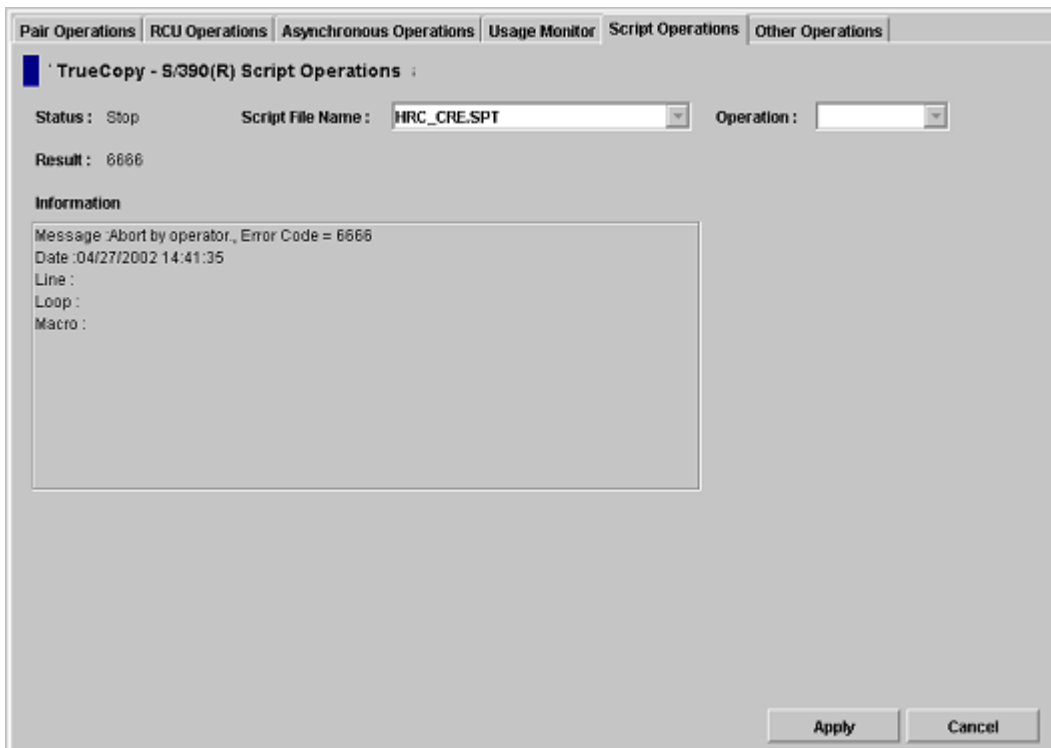



Figure 39 Script Operations window during execution of a script file

History Window

Click the **History Operations** tab to display the History Operations window, which displays the history information for the TC390 pairs. Use this window to perform TC390 history operations. The history information includes the records of the main status changes, such as pair creation and deletion, of the

TC390 pairs. See “[History Operations](#)” on page 118 for information and instructions on performing TrueCopy - S/390® history operations.

The History Operations window is updated when the **Refresh** button () is clicked. The information on the History Operations window is not updated by clicking another tab and then clicking the History Operations tab again.

Pair Operations	RCU Operations	Asynchronous Operations	Usage Monitor	Script Operations	History Operations	Other Operations
-----------------	----------------	-------------------------	---------------	-------------------	--------------------	------------------

TrueCopy - S/390(R) History Operations					
Status : Complete.					
Last Update : 2002/07/25 16:44:36					
Operation Date/Time	Start Date/Time	Operation	VOL	Paired VOL	Copy Time
2002/07/25 14:23:54		Pair Delete	00:00	00:01	
2002/07/23 16:41:28	2002/07/23 16:39:31	Pairing Complete	00:00	00:01	000:01:57
2002/07/23 16:39:31		Pairing Start	00:00	00:01	
2002/07/23 15:57:34		Pair Delete	00:00	00:02	
2002/07/22 16:25:02	2002/07/22 16:23:01	Pairing Complete	00:00	00:02	000:02:01
2002/07/22 16:23:01		Pairing Start	00:00	00:02	
2002/07/19 20:09:26		Pair Delete	0A:9E	0A:BE	
2002/07/19 20:09:26		Pair Delete	0A:9F	0A:BF	
2002/07/19 20:09:23		Pair Delete	00:9E	00:BE	
2002/07/19 20:09:23		Pair Delete	00:9F	00:BF	
2002/07/19 20:02:37		Pair Delete	1A:95	1A:B3	
2002/07/19 20:02:37		Pair Delete	1A:9D	1A:AB	
2002/07/19 20:02:37		Pair Delete	1A:99	1A:B7	
2002/07/19 20:02:37		Pair Delete	1A:9C	1A:AA	
2002/07/19 20:02:37		Pair Delete	1A:9B	1A:A9	
2002/07/19 20:02:37		Pair Delete	1A:8A	1A:A8	
2002/07/19 20:02:37		Pair Delete	1A:98	1A:A6	
2002/07/19 20:02:37		Pair Delete	1A:87	1A:A5	
2002/07/19 20:02:37		Pair Delete	1A:86	1A:A4	
2002/07/19 20:02:37		Pair Delete	1A:93	1A:B1	
2002/07/19 20:02:37		Pair Delete	1A:8E	1A:AC	

Figure 40 History Operations window

The History Operations window contains the following information:

- **Status** displays the current status of the history file:
 - **No history file exist.** The history file does not exist.
 - **Reading a history failed.** A failure occurred during referring to the history file.
 - **Update history... n (%).** Updating of the history file is now in progress. “n (%)” indicates the progress (in %) of the updating process of the history file.
 - **Complete.** Updating of the history file has been completed.

When the updating process is in progress, the checking process automatically continues until the updating process finishes. The updating process is checked at ten-second intervals.

- **Last Update** displays the updated date and time of the history file.
- The **History List** displays the history information for the TC390 pairs in the connected disk array. By default, the list is in the order in which the information are received from the disk array.

History List shows the following information:

- **Operation Date/Time:** The date and time when the operation was completed.
- **Start Date/Time:** The date and time when the operation was started.
- **Operation:** The operations are **Pairing Start** (add pair operation was started); **Pairing Complete** (add pair operation was completed); **Pair Delete** (the pair was deleted); **Suspend Operation** (pair

suspending operation was performed); **Pair Suspend (Failure)** (the pair was suspended because of a failure); **Pair Resync. Start** (resume pair operation was started); and **Pair Resync. Complete** (resume pair operation was completed).

- **VOL:** CU number and LDEV number of the operated volume.
- **Paired VOL:** CU number and LDEV number of the paired volume.
- **Copy Time:** The time taken for the operation (from the start of the operation to the end). Displayed only for **Pairing Complete** and **Pair Resync. Complete** operations.

History information older than seven days is automatically deleted. However, if the number of operations exceeds 65,535, the oldest operations are deleted in chronological order to keep the number at 65,535, even if the operations occurred within the last week. The history file always contains the most recent operations up to a maximum of 65,535 operations. The maintenance information for an entire week may not always be available.

The history information can be sorted by column and in ascending or descending order.

- **Previous** and **Next** buttons: The list displays up to a maximum of 16,384 operations at a time. Use these buttons to display the previous or next 16,384 operations.

Other Operations Window

Clicking the **Other Operations** tab displays the Other Operations window, which includes the Clear SIM function. For more information, refer to "[Script Operations](#)" on page 118.

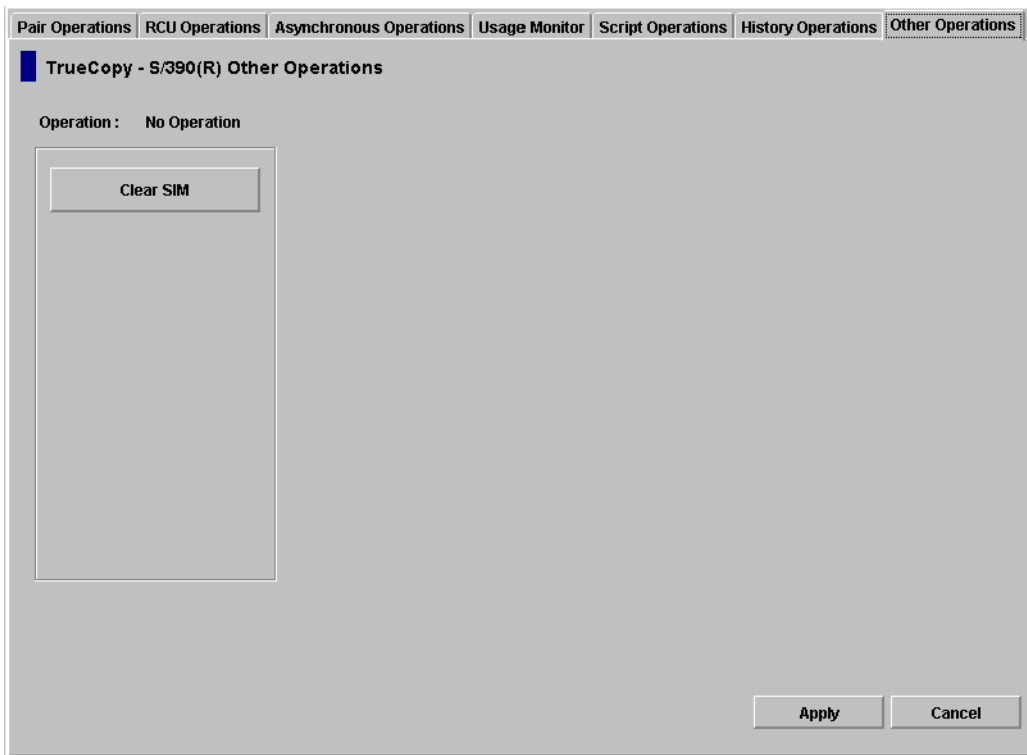


Figure 41 Other Operations window

RCU Operations

The RCUs are the control units that control the R-VOLs of the volume pairs. The RCUs are connected to the MCUs through the remote copy connections and receive and process commands from the MCUs. For TC390 operations, the secondary Command View management station at the remote site should be connected to the RCUs to allow TC390 commands to be issued directly to the RCU (for example, in case of disaster or failure at the primary site).

The MCUs are the control units which control the M-VOLs of the volume pairs. The MCUs receive and process user-requested TC390 commands from the Command View management station, and send the remote copy operations to the RCUs. The MCUs can also function as RCUs, provided the remote copy connections are properly configured.

The RCU operations are performed separately for each CU image of each MCU and RCU to provide maximum flexibility in TC390 configurations. The RCU operations are:

- Configuring the host interface ports for MCU-RCU connection (see page 90)
- Viewing RCU status (see page 91)
- Registering RCUs (see page 93)
- Setting the RCU options (see page 93)
The RCU options apply to all CU images of the MCU.
- Modifying the RCU options (see page 96)
- Deleting RCUs (see page 101)
- Adding and deleting logical paths to an RCU (see page 101)
- Adding and deleting SSIDs for an RCU (see page 104)
- Modifying parameters and omitting selected settings (see page 105)

From the RCU Operations window (see page 78), you can perform the RCU operations. All the operations that can be performed from the RCU Operations window have a common procedure.

To perform the RCU operations from the RCU Operations tab:

1. Select a CU number or a Port number in the tree.
2. Select one or more RCU or Port in the list. For registering RCU operation, RCU does not have to be selected. For this step, the list can be blank.
3. Right-click the list to display the pop-up menu.
 - a. When the **MCU&RCU** button is selected in the Display box, the pop-up menu consists of the following:
 - **RCU Status:** Displays the RCU status (see "[Viewing RCU Status \(RCU Status\)](#)" on page 91).
 - **RCU Operation:** Performs the following RCU operations: **Add RCU** (Fibre or Serial) (see "[Registering an RCU \(Add RCU\)](#)" on page 93), **Change RCU Option** (see "[Registering an RCU \(Add RCU\)](#)" on page 93 and "[Modifying RCU Options \(Change RCU Option\)](#)" on page 98), and **Delete RCU** (see "[Deleting an RCU \(Delete RCU\)](#)" on page 101).
 - **Edit SSID(s) & Path(s):** Performs the following path settings operations: **Add Path** and **Delete Path** (see "[Adding and Deleting Logical Paths for an RCU \(Add Path and Delete Path\)](#)" on page 101). Also performs the following SSID setting operations: **Add SSID** and **Delete SSID** (see "[Adding and Deleting SSIDs for an RCU \(Add SSID and Delete SSID\)](#)" on page 104).
 - b. When the **Port** button is selected at the Display box, the pop-up menu consists of **Initiator**, **RCU Target**, **Target**, **Omit**, and **Cancel All**.
4. Select a command. If two or more RCUs are selected in [step 2](#), only the **RCU Operation** command can be selected.

There is no separate window for the port change operation. Select the port type and return to the Volume list (go to [step 6](#)).

5. Click **Set**. The window closes and the MCU/RCU list changes to the **RCU Settings Parameter list**. Only the RCUs selected in [step 2](#) are listed and items in the list depend on the selected command.



NOTE: The options can be modified and/or canceled after you have set them. See "[Modifying Parameters and Omitting Selected Settings](#)" on page 105.

6. Click **Apply** on the TrueCopy main window.

The following sections describe in detail for each command and operation.

Configuring the Host Interface Ports

You can use TC390 to change the configuration of the disk array host interface ports as needed to accommodate the host and TC390 communications paths.

The disk array Fibre Channel interface ports can be configured as target ports (default), initiator ports, or RCU target ports.

- **Target:** The Fibre Channel ports that will be connected to the host must be configured as target ports (default). Target mode is used for host processor channel interface.
- **Initiator:** The Fibre Channel ports that will be used for TC390 communications to the RCUs must be configured as initiator ports. Initiator mode emulates a host channel to enable the MCU to send write I/O operations directly to the RCU target port. Two or more initiator ports must be configured before you can add the RCUs and create the TC390 pairs.
- **RCU target:** The Fibre Channel ports in the RCU that will be used to communicate with the MCUs must be configured as RCU target ports.

The disk array serial interface ports can be configured as LCPs or RCPs.

- **LCP:** The serial ports which will be connected to the host must be configured as LCPs (default). LCP mode is used for host processor channel interface. The serial ports in the RCU that will be used to communicate with the MCUs must also be configured as LCPs.
- **RCP:** The serial ports which will be used for TC390 communications to the RCUs must be configured as RCPs. RCP mode emulates a host channel to enable the MCU to send write I/O operations directly to the RCU. The RCPs must be configured before you can add the RCUs and create the TC390 pairs.

The serial interface ports, 1S-1Z and 2S-2Z, cannot be specified as RCPs.

The External port that appears on the RCU Operations window cannot be used with TC390.



NOTE: The attribute of the port assigned to SLPR except SLPRO cannot be set to the attribute except Target or LCP.

Before changing a Fibre Channel port to an initiator port, disconnect the port from the host, delete all affected TC390 pairs, delete all paths from the port to the MCU (if RCU target), and then remove all channel paths to the port.

Also, before changing a Fibre Channel port from initiator to target or RCU target, delete all affected TC390 pairs, delete all paths from the initiator port to the RCU, and then delete the RCU from the MCU.

Before changing the operation mode of a serial port from LCP to RCP, remove all channel paths to the specified port using host system console or ESCD commands. Before changing the mode of a port from RCP to LCP, delete all affected TC390 pairs, delete all paths to the RCU from that RCP, and then delete the RCU from the MCU.

Limit the number of hosts connected to an RCU target port to 128 or fewer to avoid mistaken disconnection. If more than 128 hosts are connected to an ordinary target, some hosts may be disconnected after changing the type from target to RCU target.

To configure the Fibre Channel or serial ports:

1. Click **Port** in the Display box on the RCU Operations window to change the tree to the Port tree and the list to the Port list.
2. Select a port or a port type from the Port tree. Only the selected port or the selected port type is displayed in the Port list.
3. Select the port(s) of the CU that you want to configure from the Port list.
4. Right-click to display the pop-up menu, which consists of **Initiator**, **RCU Target**, and **Target** for the Fibre Channel, or **RCP** and **LCP** for the Serial channel.
5. Click a port type from the pop-up menu.

For the port change operation, there is no separate window and the list continues to display the Port list.

Viewing RCU Status (RCU Status)

Use the **RCU Status** command to display the RCU status information.

To display the RCU status information:

1. Click **MCU&RCU** in the Display box.
2. From the CU Number/Port tree, select a CU number that includes the RCU that you want to display the status information.
3. From the MCU/RCU list, select an RCU and right-click to display the pop-up menu.

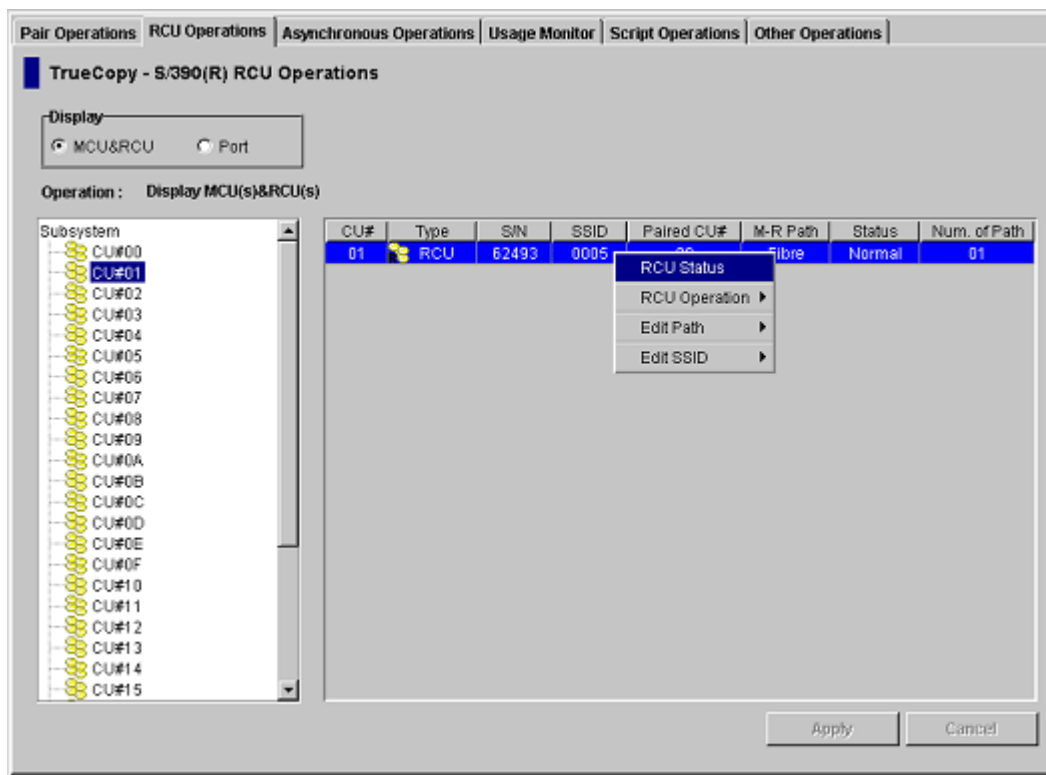


Figure 42 MCU/RCU list with the RCU Status command

4. Click **RCU Status** from the pop-up menu. The RCU Status window is displayed.



NOTE: If you select more than one RCU in [step 2](#), only **RCU Operation** can be clicked from the pop-up menu. Select one RCU in [step 2](#) to display the status information.

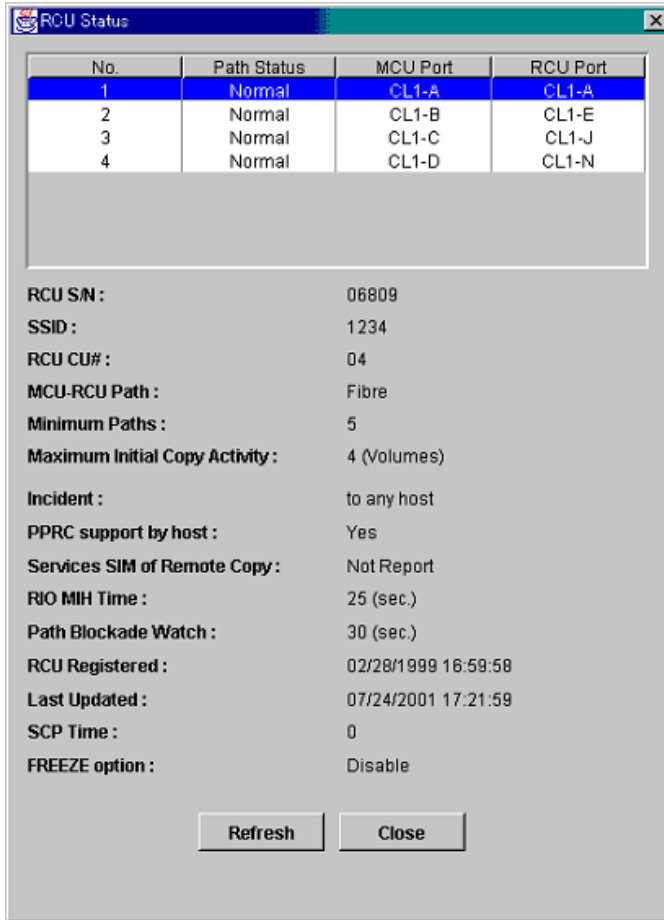


Figure 43 RCU Status window

- **Path list:**
 - **No.:** Path number (serial number of the list).
 - **Path Status:** Path status. **Normal** is displayed when the path status is normal.
 - **MCU Port** number and **RCU Port** number. When the channel type is serial, the link address is listed on the **RCU Port** column.
- **RCU S/N:** Serial number of the RCU.
- **SSID:** SSID of the RCU.
- **RCU CU#:** CU number of the RCU.
- **MCU-RCU Path:** Channel type of the path interface between the disk arrays (Serial or Fibre).
- **Minimum Paths:** Minimum number of paths required for the selected RCU connected to the MCU.
- **Maximum Initial Copy Activity:** Number of concurrent initial copy operations.
- **Incident:** The host(s) to which the RCUs will report link incident records.
- **PPRC Support by Host:** The host status of the PPRC support.

- **Service SIM of Remote Copy:** Whether the MCU will report the service-level remote-copy SIMs to the host(s).
- **RIO MIH Time:** Time value for the remote I/O (RIO) missing interrupt handler (MIH), which is the wait time until data transfer from the MCU to RCU is complete.
- **Path Blockade Watch:** Time for monitoring blockade in the Fibre Channel paths on the MCU side.
- **RCU Registered:** The date and time when the RCU is registered.
- **Last Updated:** The date and time when the RCU is last updated.
- **SCP Time:** State-Change-Pending (SCP) time.
- **FREEZE Option:** Support for the CGROUP (FREEZE/ RUN) PPRC TSO command.
- The **Refresh** button refreshes the information displayed on the window. The **Close** button closes the window.

The **Path Status** box lists the path status and the following table describes each status. For troubleshooting information about MCU-RCU paths, see [“General TrueCopy Troubleshooting”](#) on page 153.

Table 17 Logical path status

Status Description	Condition
Normal	This logical path has been successfully established and can be used for TC390 remote copy activities.
Initialization Failed	The link initialization procedure with the RCU has failed because either the physical path connection between the MCU and the RCU or the connection between the MCU and the host was missing.
Communication Timeout	A timeout error has occurred between the MCU and RCU.
Resource Shortage	The establish logical path link function has been rejected by the RCU. All logical path resources in the RCU might be used for other connections.
Serial Number Mismatch	The serial number of the control unit that is connected to this logical path does not match the serial number specified by the Add RCU window.
Invalid Port	The serial interface port specified is not in the RCP or Initiator mode.
RCU Port Number Mismatch	There are three possible factors as follows: <ul style="list-style-type: none"> • The specified port in the RCU is physically disconnected from the MCU. • The port is not configured as an RCU target port. • The specified port number is not available.
RCU Port Type Mismatch	The microprogram at the RCU side does not support the Fibre remote copy function. Or the specified port type is not RCU Target.
Communication Failed	A timeout error has occurred on the Fibre path between MCU and RCU.

Registering an RCU (Add RCU)

You can register up to four RCUs to each MCU, and establish up to eight paths to each RCU. You must register each CU image as a separate RCU. The logical paths are established for the CU images of the

MCU and RCU separately. The maximum number of logical paths for each MCU is 32 (8 paths per RCU × 4 RCUs per MCU).

The remote copy connections and MCU ports must be properly installed and configured before you can register an RCU. When you register an RCU, the current CU image of the MCU registers the specified CU image as a TC390 RCU and establishes the specified number of logical paths to the RCU. After you have registered an RCU (and path status is normal), you can create TC390 pairs that have R-VOLs in the newly registered RCU.

Use the Add RCU window to register the RCU(s) to the current CU image of the connected MCU. When the **Add RCU** command for each channel type is selected, the Add RCU window is displayed and you can set the RCU(s) to be registered.



NOTE: If four RCUs (the maximum number of RCUs you can register) have already been registered, the **Add RCU** command cannot be selected.

The figure shows two side-by-side Java Applet windows for adding an RCU. The left window, titled "Add RCU", contains fields for "RCU S/N" (62492), "Controller ID" (3), "Logical Adr.(RCU CU#)" (01), and "SSID" (5). Below these is an "MCU-RCU Path" section with a table of "MCU Port" and "RCU Port" dropdowns. The right window, titled "Add RCU (Serial)", contains fields for "RCU S/N" (30075), "Logical Adr.(RCU CU#)" (04), and "SSID" (1019). It also has an "MCU-RCU Path" section with a table of "MCU Port" and "Link Address" dropdowns. Both windows have "Option" and "Cancel" buttons at the bottom.

Figure 44 Add RCU windows (Fibre and Serial)

Use the **RCU S/N**, **Controller ID**, and **Logical Adr. (RCU CU#)** boxes to enter the serial number, Controller ID (subsystem family ID), and CU number of the RCU being registered. S/N is in five-digit and CU number is 0-1F. For the Controller ID (for Fibre port type), enter "2" for an XP48/XP512 or "3" for an XP128/XP1024/XP12000.

Use the **SSID** boxes to enter the SSID(s) of the RCU being registered. The XP128/XP1024/XP12000 uses one SSID for each set of 256 volumes and four SSIDs per CU image. SSID is 4-FFFE in hexadecimal.

The **MCU-RCU Path** box includes:

- The **MCU Port** box, which you use to enter the MCU port number. Only the Initiators are listed in the list and you can select the MCU port from the list.

- The **RCU Port** box, which you use to enter the RCU port number. The RCU Target port must be selected. This box is for Fibre port type.
- The **Link Address** box, which you use to enter the link address. The link address is 0-FD in hexadecimal. This box is for Serial port type.

The **Option** button opens the RCU Option window. The **Cancel** button cancels the settings you made on the Add RCU window, and closes the window.

To register an RCU to the connected MCU:

1. Verify the remote copy connections and MCU ports are properly configured. Get the S/N of the RCU and the SSID(s) for the CU image in the RCU. The register RCU operation will fail without this information. The XP128/XP1024/XP12000 should have a label or tag indicating its S/N and SSIDs. The HP representative can also get the RCU S/N and SSIDs using the RCU's SVP at the remote site.
2. Click **MCU&RCU** in the Display box.
3. From the CU number tree on the RCU Operations window, select the correct CU image. For this step, the list can be blank. You must register RCUs to each CU image separately.
4. From the MCU/RCU list on the RCU Operations window, right-click to display the pop-up menu. For registering RCU operation, the RCU does not have to be selected on the list.
5. From the pop-up menu, click **RCU Operation** and then click **Add RCU** (see Figure 45). The Add RCU window is displayed.

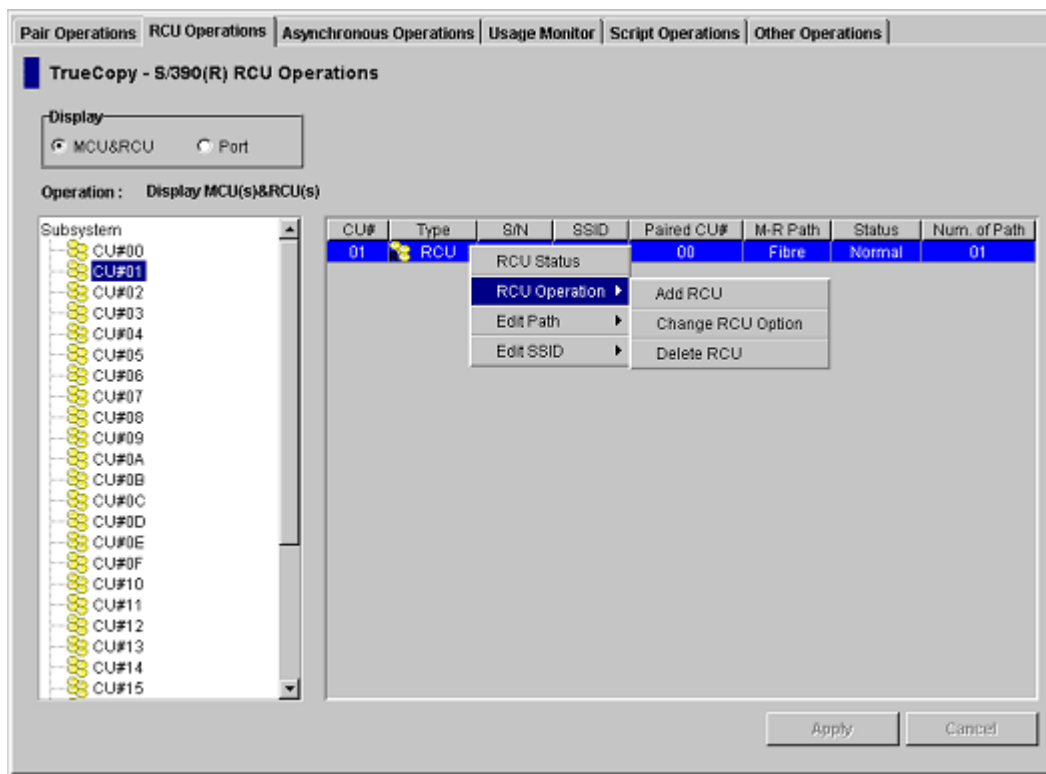


Figure 45 MCU/RCU list with the RCU Operation command

6. From the Add RCU window, enter the S/N of the RCU and the Controller ID, CU number, and SSID(s) for the CU image. You can enter the Controller ID for Fibre port type. The MCU verifies the S/N when the paths are established, and verifies the SSIDs when the volume pairs are created. If needed, add and delete SSIDs later using the Add SSID window (see "Adding and Deleting SSIDs for an RCU (Add SSID and Delete SSID)" on page 104).
7. Select the **MCU Port** and the **RCU Port**. The MCU will not establish less than the minimum number of paths as specified on the RCU Option window. If needed, add and delete paths later using the Add

Path window (see “Adding and Deleting Logical Paths for an RCU (Add Path and Delete Path)” on page 101).

8. Click **Option** to open the RCU Option window. To cancel the settings you made on the Add RCU window, click **Cancel**.
9. From the RCU Option window, enter or select the settings for adding RCU parameters. For multiplatform XP128/XP1024/XP12000 configurations with both TC390 and CA paths, set the **Maximum Initial Copy Activity** to **4 Volumes**.
10. From the RCU Option window, click the **Set** even if you made no changes. To cancel the settings, click **Cancel**. The list changes to the **RCU Settings Parameter list**.
11. The new RCU is displayed in the **RCU Settings Parameter list**. To check the path status for this RCU, select the RCU, right-click to display the pop-up menu, and then click **RCU Status**. For detailed information on the path status, refer to Table 25 on page 155.



NOTE: The options can be modified and/or canceled after you have set them. See “Modifying Parameters and Omitting Selected Settings” on page 105.

12. Click **Apply** on the TrueCopy main window.

RCU Path Parameters

For serial channel interface, the RCU path parameters are similar to the channel path definitions in the I/O configuration dataset (IOCDS). In the IOCDS, a logical path is specified with a subchannel number, link destination address, and logical address for the CU. TC390 uses the “port” parameter instead of the subchannel number to specify the MCU’s port. For the XP128/XP1024/XP12000, the logical address must correspond to the CU number. The following figures shows a sample TC390 serial channel configuration with two paths.

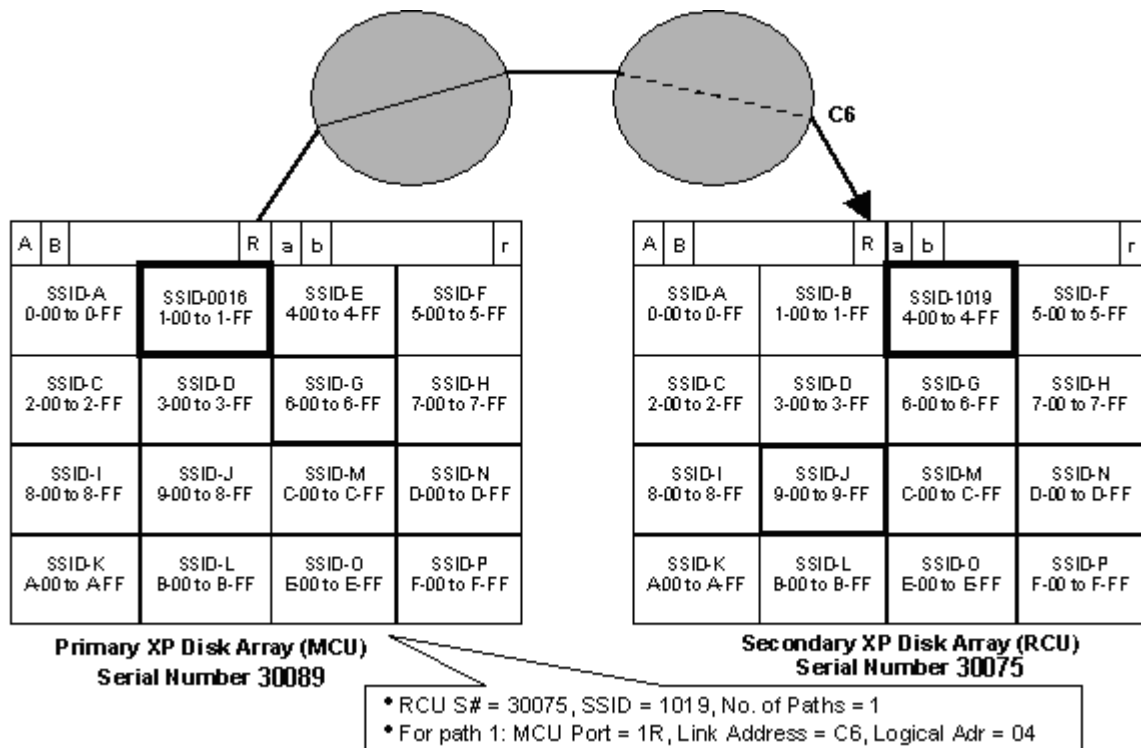


Figure 46 Typical TC390 remote copy configuration with two paths

Add RCU (Serial)

RCU SIN: 30075

Logical Adr.(RCU CU#): 04

SSID: 1019

MCU-RCU Path	
MCU Port	Link Address
CL1-R	C6

Option Cancel

Figure 47 Add RCU window – serial interface

For Fibre Channel interface, two types of fibre-channel ports are provided: 4-port and 2-port adapters. The port mode depends on the port type. Also, each port may have a different PCB mode setting (Standard or High). Therefore, when you configure paths among the initiator ports, target ports, and RCU target ports, please study the port modes and specify the correct mode for each port. The following figures shows a sample TC390 Fibre Channel interface configuration with connections going through switches and the TC390 Add RCU window used to define this configuration.

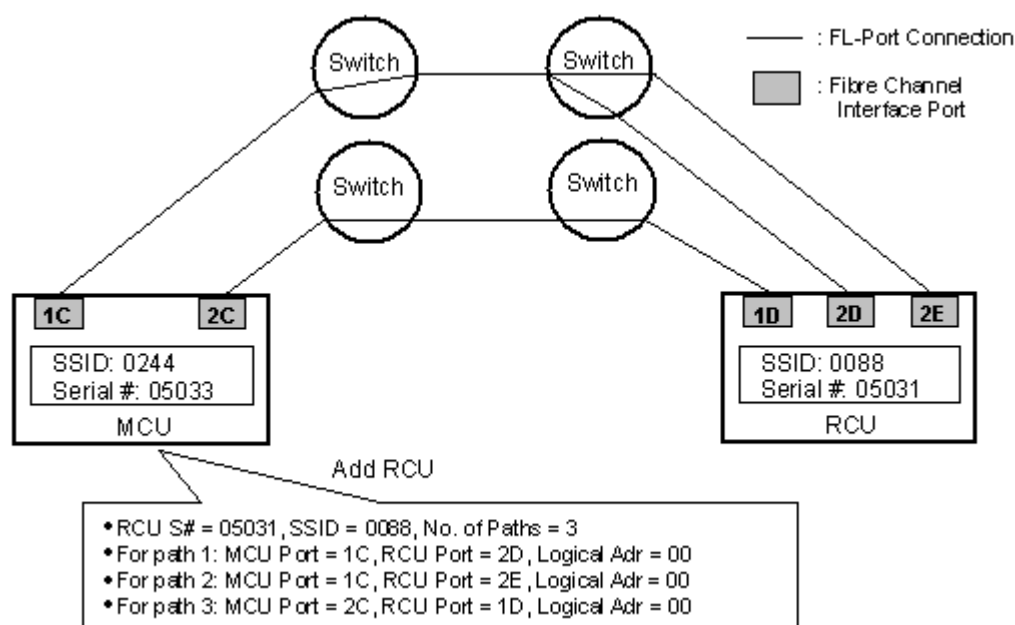


Figure 48 Fibre Channel interface connections going through switches

Add RCU

RCU S/N: 05031

Controller ID: 3

Logical Adr.(RCU CU#): 00

SSID: 0088

MCU-RCU Path

MCU Port	RCU Port
CL1-C	CL2-D
CL1-C	CL2-E
CL2-C	CL1-D

Option Cancel

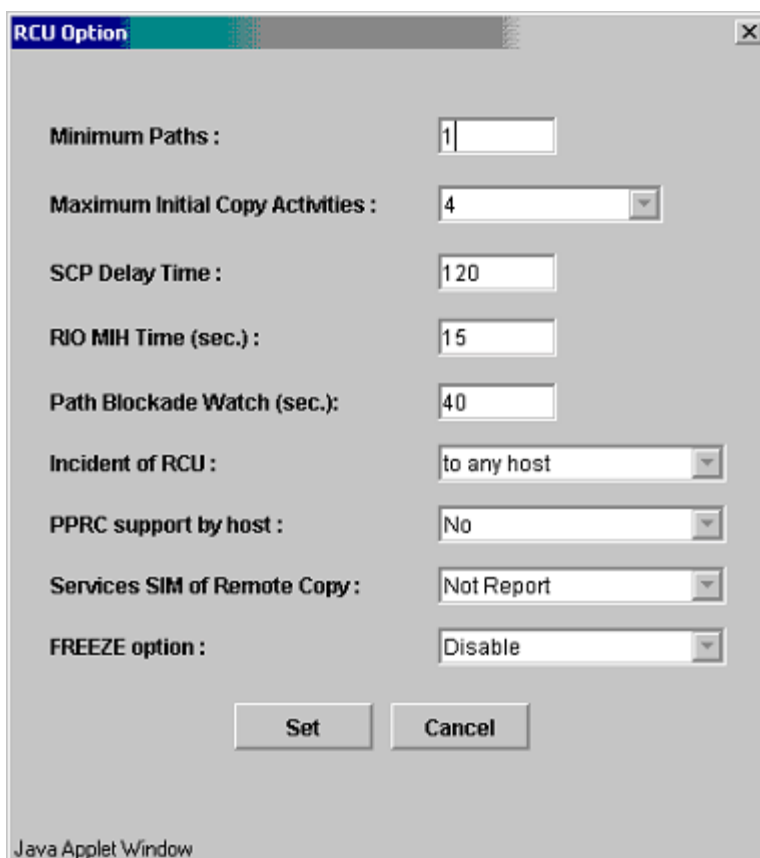
Java Applet Window

Figure 49 Add RCU window – FC interface

Modifying RCU Options (Change RCU Option)

Use the RCU Option window to set the RCU options for the connected MCU. The RCU options apply to all MCU CU images and to all RCUs connected to the MCU. The RCU Option window is presented during

the add RCU process, and can also be opened by right-clicking on the RCUs and clicking **RCU Operation** > **Change RCU Option**.



The image shows a Java Applet window titled "RCU Option". It contains several configuration fields:

- Minimum Paths :** A text input field containing the value "1".
- Maximum Initial Copy Activities :** A dropdown menu showing the value "4".
- SCP Delay Time :** A text input field containing the value "120".
- RIO MIH Time (sec.) :** A text input field containing the value "15".
- Path Blockade Watch (sec.):** A text input field containing the value "40".
- Incident of RCU :** A dropdown menu showing the value "to any host".
- PPRC support by host :** A dropdown menu showing the value "No".
- Services SIM of Remote Copy :** A dropdown menu showing the value "Not Report".
- FREEZE option :** A dropdown menu showing the value "Disable".

At the bottom of the window are two buttons: "Set" and "Cancel". The text "Java Applet Window" is visible at the very bottom left of the window frame.

Figure 50 RCU Option window (Change RCU Option)

Use the **Minimum Paths** option to specify the minimum number of paths required for each RCU connected to the current MCU. You can specify 1, 2, 3, 4, or 8 for this option. If the number of paths falls below the specified number (for example, due to a failed path), the MCU will suspend all affected TC390 (and TC) pairs to prevent remote copy operations from adversely affecting performance due to the inadequate number of paths. For TC390 pairs that contain critical data for disaster recovery, the minimum number of paths should be set to one so that TC390 operations continue even if there is only one path to an RCU. If you need to maintain high performance at the MCU, set the minimum paths to two or more (max paths = 8 for fibre, 8 for serial 2105, 4 for serial 3990), depending on the number of pairs managed by the MCU.



CAUTION: If TC390 volume pairs are suspended because the number of paths has dropped below this setting, the M-VOL fence-level pair option (see ["Creating TrueCopy Volume Pairs \(Add Pair\)"](#) on page 126) determines whether the TC390 Synchronous M-VOLs are fenced (that is, reject all write operations).

The **Maximum Initial Copy Activity** setting specifies the number of concurrent initial copy operations (minimum = 1, maximum = 4). TC390 initial copy activities can impact the performance of the main disk array, depending on the amount of I/O activity and the number of pairs being added at the same time. The maximum initial copy activity setting limits the impact of initial copy activities on disk array performance. For example, if you set the maximum initial copy activity to four and then add five TC390 pairs at the same time, the MCU starts the first four pairs and will not start the fifth pair until one of the first four pairs is synchronized. The maximum initial copy activity value can be set only when adding new pairs. After you have added a TC390 volume pair, this setting cannot be changed for that pair.

The **SCP Delay Time** setting specifies the state-change-pending (SCP) delay time in seconds (0-600 seconds). CGROUP/FREEZE uses the SCP state to suspend host I/Os to TC390 M-VOLs (see "[CGROUP \(FREEZE/RUN\) Support](#)" on page 174). TC390A uses the SCP state for inflow control to prevent cache storage overload (see "[Inflow Control of Recordsets](#)" on page 40). Make sure to set the SCP delay time after you have added all MCU-RCU paths.



CAUTION: You must click **OK** on the RCU Option window to register the **SCP Delay Time** setting, even if you did not make any changes to the RCU options. Ensure to select the appropriate SCP delay time for your TC390 system configuration.

The **RIO MIH Time** setting specifies the time value for the remote I/O (RIO) missing interrupt handler (MIH), which is the wait time until data transfer from the MCU to RCU is complete. The RIO MIH time value must be from 10 to 100 seconds. The default setting is 15 seconds. This setting is available for both serial and Fibre Channel interfaces. For more information on the MIH, refer to the "[Installing the TrueCopy Hardware](#)" on page 57.

The **Path Blockade Watch** setting specifies the time for monitoring blockade in the Fibre Channel paths on the MCU side. The path blockade watch value must be from 0 to 45 seconds. The default setting is 40 seconds. This setting is available for Fibre Channel interface only.

Use the **Incident of RCU** option to specify which host(s) the RCUs will report link incident records to. When **to any host** is selected, the RCUs will send link incident records to all RCU hosts and to all MCU hosts. When **only to RCU host** is selected, the RCUs send link incident records only to the RCU host(s). Verify that RCU link incidents are reported to the proper host(s) so that corrective action, if needed, can be taken. The **to any host** setting is recommended when TC390 is being used for disaster recovery purposes.

Use the **PPRC support** option to specify whether the MCU will generate sense information that is compatible with IBM PPRC. This option is extremely important for TC390 disaster recovery planning. If the host does not support PPRC, select **No** to configure the MCU to report SIMs. If the host system supports PPRC, select **Yes** to configure the MCU to generate PPRC-compatible sense information when a TC390 pair is suspended instead of a service information message (SIM). If **Yes** is selected, the MCU will still report moderate- and serious-level SIMs, as well as DF40 and DF48 device SIMs. For more information on PPRC support, refer to "[Using PPRC Commands for TrueCopy](#)" on page 160.



NOTE: If you plan to use the CGROUP (FREEZE/RUN) command for TC390 pairs, you must select **Yes**.

Use the **Service SIM of Remote Copy** option to specify whether the MCU will report the service-level remote-copy SIMs to the host(s). (The moderate-, serious-, and acute-level SIMs are always reported to the host.) Select **Report** to configure the MCU to report the service-level remote-copy SIMs to the host(s). The **Report** setting should be selected for TC390 disaster recovery planning. Select **Not Report** to suppress service-level SIM reporting. For a description of the TC390 and TC390A SIMs, see "[SIM Reporting](#)" on page 190. All service-level SIMs will be logged in the SSB.LOG file on the XP128/XP1024/XP12000 SVP, regardless of this setting.

The **FREEZE Option** setting enables or disables support for the CGROUP (FREEZE/ RUN) PPRC TSO command (see "[CGROUP \(FREEZE/RUN\) Support](#)" on page 174). The FREEZE option is available only when PPRC support = Yes. If you select **Enable**, the MCU will accept and perform the CGROUP command. If you select **Disable**, the MCU will reject the CGROUP command. Enable the FREEZE option only after all MCU-RCU paths have been added.

The **Cancel** button cancels the registering RCU operation. The **Set** button sets the registering RCU operation with the option you set on the RCU Option window.



NOTE: You cannot use the PPRC commands to change the RCU options. For more information on PPRC TSO and ICKDSF commands, refer to ["Using PPRC Commands for TrueCopy"](#) on page 160.

To modify the RCU option:

1. From the CU Number tree on the RCU Operations window, verify the correct CU image is selected.
2. From the MCU/RCU list on the RCU Operations window, select RCU whose options you want to modify.
3. Right-click to display the pop-up menu, click **RCU Operation**, and then click **Change RCU Option**. The RCU Option window is displayed.
4. From the RCU Option window, modify the RCU options. When the RCU Option window is opened, all the boxes display the current settings. Complete the boxes with the RCU options you want to modify.
5. Click **Set** to set the changes you made. The list changes to the RCU Settings Parameter list (RCU Option). To cancel all the changes you made, click **Cancel**.



NOTE: The options can be modified and/or canceled after you have set them. See ["Modifying Parameters and Omitting Selected Settings"](#) on page 105.

6. Click **Apply** on the TrueCopy main window.

Deleting an RCU (Delete RCU)

You can delete an RCU from an MCU only after all TC390 volume pairs between the MCU CU image and RCU CU image have been deleted. When you delete an RCU from an MCU, the MCU deletes all logical paths from the current MCU CU image to the selected RCU CU image. Deleting an RCU does not affect the TC390 operations between the other MCU CU images and that RCU. After an RCU has been deleted, you can reconfigure the remote copy connections to add another RCU to the MCU, or you can remove the remote copy connections and reconfigure the MCU ports (RCPs to LCPs for serial; initiator ports to ordinary target ports for fibre) to provide additional host channels for the MCU.

Use the **Delete RCU** command to delete the selected RCU from the current MCU CU image. If all affected pairs have not been deleted, the MCU will reject the delete RCU operation to prevent accidental deletion of TC390 pairs.

To delete an RCU from an MCU:

1. Connect to the MCU.
2. Verify that all affected TC390 volume pairs have been deleted. The volume pairs that consist of a M-VOL in the connected MCU and CU image and an R-VOL in the selected RCU must be deleted.
3. From the CU number/Port tree on the RCU Operations window, verify the correct CU image is selected.
4. From the MCU/RCU list on the RCU Operations window, select the RCU that you want to delete.
5. Right-click to display the pop-up menu, click **RCU Operation**, and then click **Delete RCU**.
6. Click **Apply** on the TrueCopy main window.

Adding and Deleting Logical Paths for an RCU (Add Path and Delete Path)

Before adding a path to an RCU, verify that the remote copy connection is properly installed, that the appropriate MCU ports are configured as RCPs (serial) or Initiator ports (fibre), and that the appropriate MCU CU image is selected. You can add up to four RCUs to each MCU CU image and establish up to eight paths to each RCU. When you add a path to an RCU, TC390 will automatically start using the new path to perform TC390 copy activities.

When the **Add Path** command is selected, the Add Path window is displayed. Use the Add Path window to set the path(s) to an RCU.

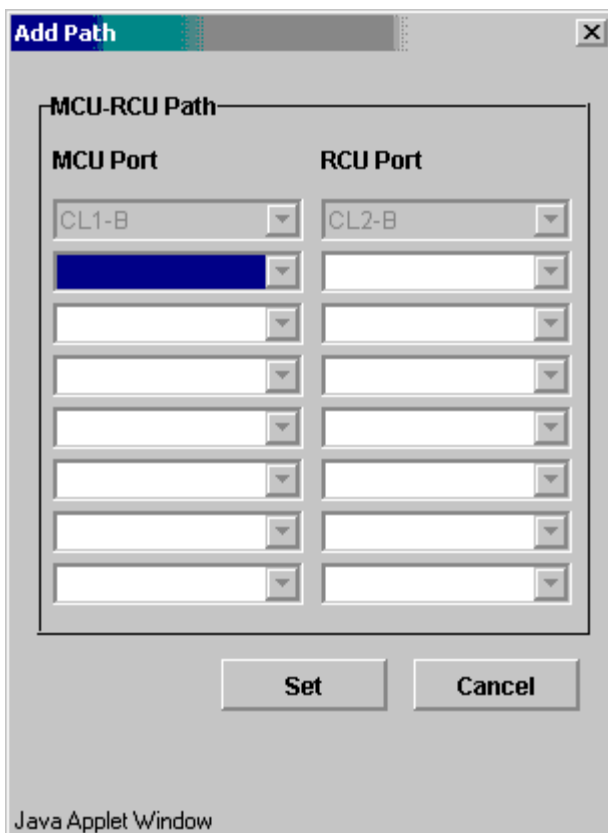


Figure 51 Add Path window (for Fibre)

The **MCU-RCU Path** box includes:

- The **MCU Port** boxes, which you use to enter the MCU port number. The Initiator and the RCP are listed in the list and can be selected.
- The **RCU Port** boxes, which you use to enter the RCU port number. The RCU Target port must be specified.
- The **Link Address** boxes, which you use to enter the Link Address.

The **Cancel** button cancels the settings you made. The **Set** button applies the settings you made and changes the list.



NOTE: The number of effectively displayed boxes depends on the number of paths that can be added.

For more information on the path status, refer to [Table 25](#) on page 155.

To add a new logical path from the connected MCU to an existing RCU:

1. From the CU Number tree on the RCU Operations window, verify the correct CU image is selected.
2. From the MCU/RCU list on the RCU Operations window, select the RCU to which you want to add a path.

3. Right-click to display the pop-up menu, click **Edit SSID(s) & Path(s)**, and then click **Add Path** (see [Figure 52](#)). The Add Path window is displayed.

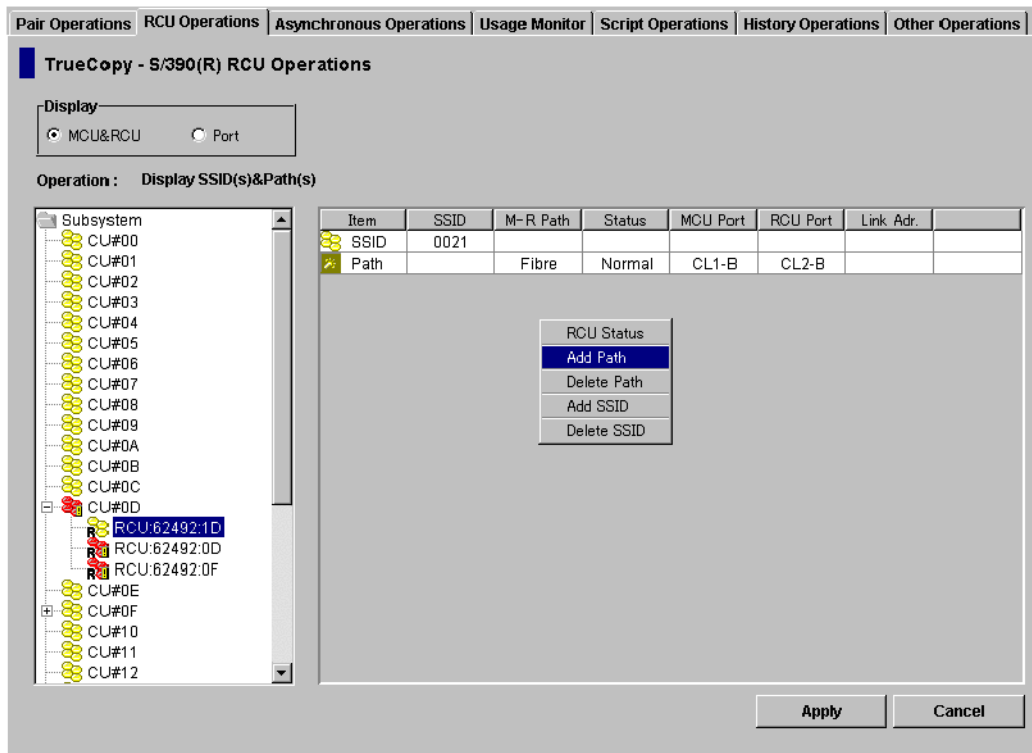


Figure 52 Opening the Add Path window

4. From the Add Path window, enter the new path(s).
5. Click **Set** in the Add Path window to set the paths. The list changes to the **Path Settings Parameter list**.



NOTE: The options can be modified and/or canceled after you have set them. See ["Modifying Parameters and Omitting Selected Settings"](#) on page 105.

6. Click **Apply** on the TrueCopy main window. The MCU will automatically begin using the new logical path for TC390 activities.

Before deleting a path to an RCU, verify that the remaining number of paths will be equal to or greater than the minimum number of paths setting (selected on the RCU Option window). The delete path operation will fail if the number of remaining paths is less than the minimum number of paths.

To delete a path from the connected MCU to an existing RCU:

1. Open the RCU Option window and check the minimum number of paths setting. If the remaining number of paths will be less than this value, the delete path operation will fail. If needed, change the minimum number of paths so that you can delete the appropriate path.
2. From the CU Number/Port tree on the RCU Operations window, verify the correct CU image is selected.
3. From the MCU/RCU list on the RCU Operations window, select the RCU with the path you want to delete.
4. Right-click to display the pop-up menu, click **Edit SSID(s) & Path(s)**, and then click **Delete Path**. The list changes to the **Path Settings Parameter list**. Only the selected RCUs are listed.



NOTE: The options can be modified and/or canceled after you have set them. See "[Modifying Parameters and Omitting Selected Settings](#)" on page 105.

5. Click **Apply** on the TrueCopy main window.

Adding and Deleting SSIDs for an RCU (Add SSID and Delete SSID)

Before adding an SSID, verify that the remote copy connection is properly installed. You can add three SSIDs to each RCU. Before deleting an SSID, verify the remaining SSIDs are still valid, or the connection between the MCU and RCU may be lost.

When the **Add SSID** command is selected, the Add SSID window is displayed. Use the Add SSID window to add three SSIDs at once to the selected RCU CU image.

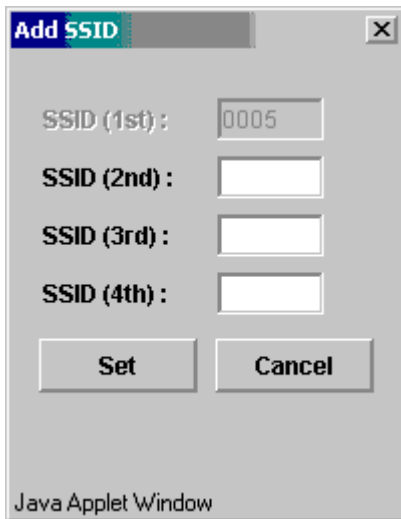


Figure 53 Add SSID window

The Add SSID window displays three SSID boxes to enter. You can enter up to three SSIDs at once with the Add SSID window. You can add up to four SSIDs (the maximum number of the SSID) in total.

The **Cancel** button cancels the settings you made. The **Set** button applies the settings you made and changes the list.

To add or delete an SSID for an existing RCU:

1. From the CU Number tree on the RCU Operations window, verify the correct CU image is selected.
2. From the MCU/RCU list on the RCU Operations window, select the RCU that you want to add or delete the SSID(s).
3. To add an SSID:
 - a. Right-click to display the pop-up menu, click **Edit SSID(s) & Path(s)**, and then click **Add SSID**. The Add SSID window is displayed.
 - b. From the Add SSID window, enter the new SSID(s) in the SSID boxes. You can add up to four SSIDs (in total) to the RCU.
 - c. Click **Set** to add the SSIDs. The list changes to the **SSID Settings Parameter list**. The added SSIDs are listed.



NOTE: The options can be modified and/or canceled after you have set them. See “[Modifying Parameters and Omitting Selected Settings](#)” on page 105.

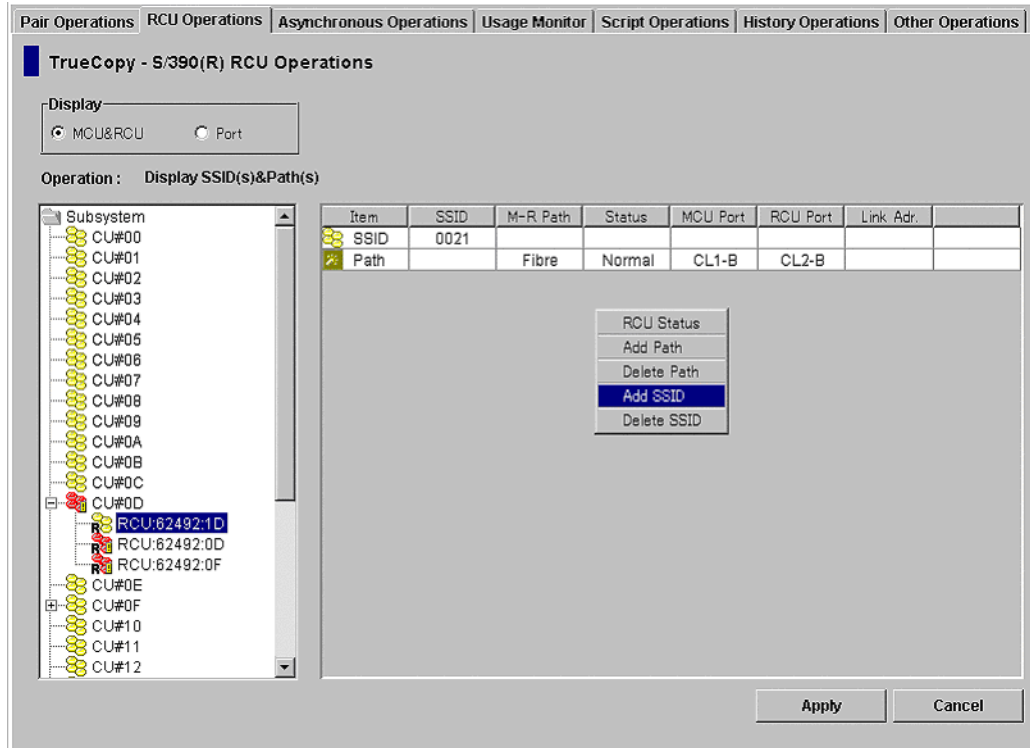


Figure 54 Opening the Add SSID window

- To delete the SSID(s): Right-click to display the pop-up menu, click **Edit SSID(s) & Path(s)**, and then click **Delete SSID**. The list changes to the **SSID Settings Parameter list**. Only the RCUs that are to be deleted are listed.



NOTE: The options can be modified and/or canceled after you have set them. See “[Modifying Parameters and Omitting Selected Settings](#)” on page 105.

- Click **Apply** on the TrueCopy main window.

Modifying Parameters and Omitting Selected Settings

After the RCU, Path, and/or SSID operation, the parameters can be modified individually. Also the RCUs, Paths, and/or SSIDs that you have set by the each operation can be omitted from the pair operation.

To modify the parameters:

- Select a RCU, Path, or SSID whose parameters you want to modify on the list.
- Right-click to display the pop-up menu and click **Modify** to modify the parameters. A window for each operation is displayed.
- Modify the parameters and click **Set** in the window.
- Click **Apply** on the TrueCopy main window.



NOTE: After the delete operation of the RCU, Path, and/or SSID operation, the **Modify** command is not available.

To omit the RCUs, Paths, or SSIDs from the operation:

1. Select the RCUs, Paths, or SSIDs to be omitted from the operation on the list.
2. Right-click to display the pop-up menu and click **Omit**. The RCUs, Paths, or SSIDs selected in [step 1](#) are deleted from the list, and the deleted RCUs, Paths, or SSIDs have been removed from the operations.
3. Click **Apply** on TrueCopy main window.

The **Cancel All** command deletes all the RCUs, Paths, or SSIDs on the list, and all the RCUs, Paths, or SSIDs have been removed from the operations. All the RCUs, Paths or SSIDs can also be deleted from the list using the **Omit** command by selecting all of the RCUs, Paths, or SSIDs on the list. When all the RCUs, Paths, or SSIDs are deleted from the list (by the **Cancel All** or **Omit** command), the list status becomes the Volume list.

Asynchronous Operations

The TC390A control operations include:

- Viewing consistency group status (see page 107)
- Adding consistency groups (see page 109)
- Modifying the consistency group options (see page 110)
- Deleting consistency groups (see page 112)
- Setting the Asynchronous copy options (see page 112)
- Modifying parameters and omitting consistency groups (see page 113)

Click the **Asynchronous Operations** tab (see page 82) to perform the asynchronous operations. All the operations that can be performed from the Asynchronous Operations window have a common procedure.

To perform the asynchronous operations:

1. Select a consistency group mode (**Display All**, **Used**, or **Not Used**) in the Consistency Group tree.
2. Select one or more consistency group in the Consistency Group list.
3. Right-click to display the pop-up menu. The pop-up menu consists of the following:
 - **Async Option:** Sets the parameters for the asynchronous copy operation (see "[Asynchronous Copy Option](#)" on page 112).



NOTE: For more information about CLPRs, see the *HP StorageWorks Command View XP for XP Disk Arrays User Guide*.

- **CT Group Operation:** Performs the following consistency group operations: **CT Group Status** (see "[Viewing Consistency Group Status \(CT Group Status\)](#)" on page 107), **Add CT Group** (see "[Adding Consistency Groups \(Add CT Group\)](#)" on page 109), **CT Group Option** (see "[Modifying](#)

Consistency Group Options (CT Group Option)” on page 110), and **Delete CT Group** (see “Deleting Consistency Groups (Delete CT Group)” on page 112).

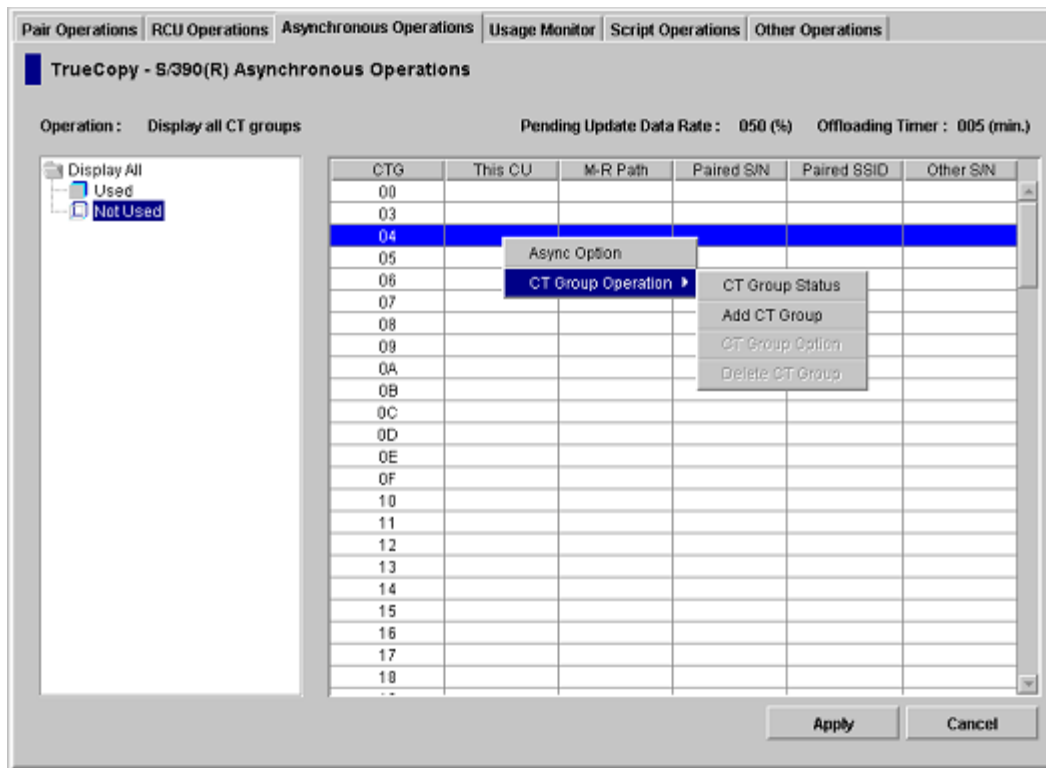


Figure 55 Consistency Group list

4. Select a command and use the window to make your settings.
5. Click **Set**. The Consistency Group list changes to the Consistency Group Settings Parameter list or the Asynchronous Options Settings Parameter list. Only the consistency groups selected in [step 2](#) are listed and items in the list depend on the selected command.



NOTE: The options can be modified and/or canceled after you have set them. See “[Modifying Parameters and Omitting Consistency Groups](#)” on page 113.

6. Click **Apply** on the TrueCopy main window.

The following sections describe in detail for each command and operation.

Viewing Consistency Group Status (CT Group Status)

The **CT Group Status** command can be used to display the consistency group status information.

To display the consistency group status information:

1. From the Consistency Group tree, select the consistency group mode that includes the consistency group with the status information you want to display.
2. From the Consistency Group list, select a consistency group. Select only one consistency group.

- Right-click to display the pop-up menu, click **CT Group Operation** and then click **CT Group Status**. The CT Group Status window is displayed.

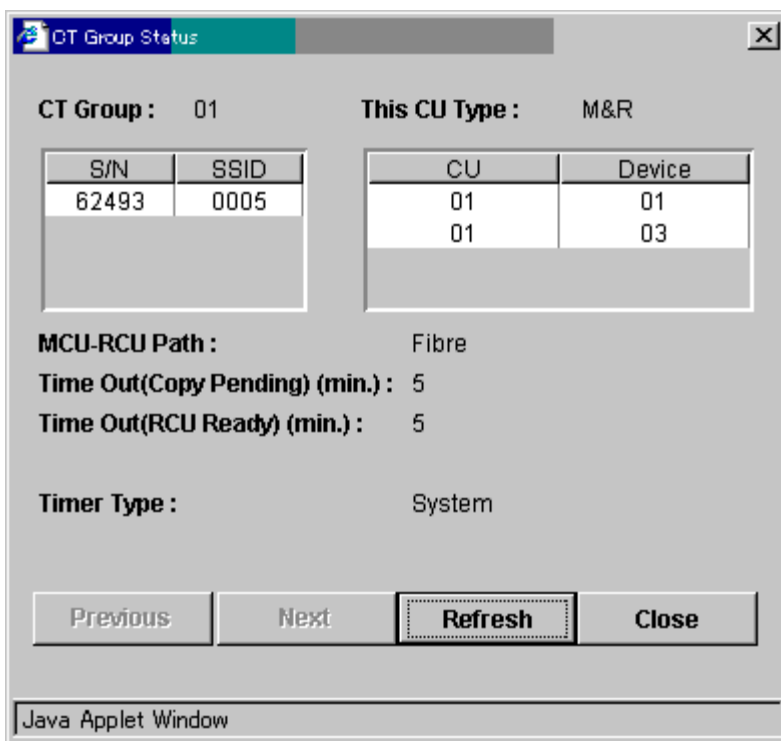


Figure 56 CT Group Status window

- **CT Group**: Consistency group number of the selected consistency group in the list.
- **This CU Type**: Registering side (MCU or RCU) of the consistency group.
- **CLPR**: The number and name of the CLPR to which the volumes forming pairs belong.
- **S/N, SSID list box**: Serial number and SSID of the CUs that are the components of the selected consistency group.
- **Pair list box**: Pair list of the original CU of the selected consistency group. For a device that is set with more than one path, only the first path is listed.
- **MCU-RCU Path**: Channel type of the path interface between the disk arrays (Serial or Fibre).
- **Time Out (Copy Pending)**: The maximum delay allowed for TC390A copy (see ["Adding Consistency Groups \(Add CT Group\)"](#) on page 109).
- **Time Out (RCU Ready)**: The maximum delay allowed for re-establishing MCU-RCU communications following MCU power-off (see ["Adding Consistency Groups \(Add CT Group\)"](#) on page 109).
- **C/T**: Current consistency time of this group (For the TC390A pairs only).
- **Timer Type**: Specified timer type of this group (For the TC390A pairs only).
- **SEQCHK: Yes** indicates that at least one pair of this group has SEQCHK status (For the TC390A pairs only).



NOTE:

- The RCU manages the C/T and SEQCHK status, and the MCU acquires these from the RCU. If MCU-RCU communications are down, the MCU may not display the latest C/T and SEQCHK information. Always use the group status and R-VOL status displayed at the RCU for disaster recovery.

- The SEQCHK status is also displayed as a TC390A pair status. To determine exactly which pair(s) in the group has the SEQCHK status, check the R-VOL pair status at the RCU.

The **Previous** button displays information about the consistency group before the current consistency group. The **Next** button displays information about the consistency group after the current consistency group. The **Refresh** button refreshes the displayed information. The **Close** button closes the CT Group Status window.

Adding Consistency Groups (Add CT Group)

The **Add CT Group** command adds a consistency group to the connected MCU. When the **Add CT Group** command is selected, the Add CT Group window is displayed. Use the Add CT Group window to select the group options for the group.

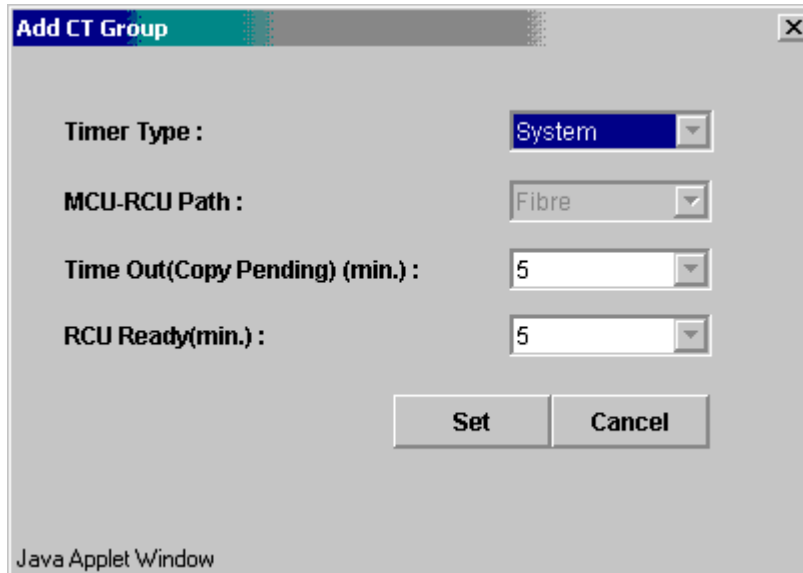


Figure 57 Add CT Group window

Use the **Timer Type** box to select the timer type option for the group.

- **System** = system timer (CPU TOD clock) provided by the I/O time-stamping function.
- **Local** = local timer (internal MCU TOD clock).
- **None** = system timer (CPU TOD clock) provided by the I/O time-stamping function. This timer type should be selected only when establishing TC390A pairs in the reverse direction (to copy from the secondary site back to the primary site). When **None** is selected, the MCU still acquires the time-stamp information from the host I/O time-stamping function.

Use the **MCU-RCU Path** box to select the port type (**Fibre**) for the remote copy connections.

Use the **Time Out (Copy Pending) (min.)** box to select the maximum delay allowed for TC390A copy (none or from 3 to 15 min., none = no timeout for TC390A copy pending). The default setting is five minutes. If the delay between the TC390A M-VOL update and the corresponding R-VOL update reaches the specified time, the RCU will suspend all R-VOLs in the group. A timeout occurs when the RCU was not able to settle a recordset within the specified time, or when the RCU has not had any communication from one of the MCUs in the group within the specified time.



NOTE: The copy pending timeout value should be less than the I/O timeout value of the host system.



CAUTION: For instructions on selecting the correct **Time Out (Copy Pending)** setting for your operational environment, see [step 9](#) below.

Use the **Time Out (RCU Ready) (min.)** box to select the maximum delay allowed for re-establishing MCU-RCU communications following MCU power-off (none or from 0 to 10 min., 0 = no timeout for TC390A RCU ready). The default setting is five minutes. If the MCU is not able to re-establish communication with the RCU within the specified time, the MCU suspends all M-VOLs in the group.

The **Cancel** button cancels the settings you made. The **Set** button sets the consistency group options you changed.

To add a consistency group:

1. Connect to the MCU.
2. Verify that the async options are configured as needed (refer to "[Asynchronous Copy Option](#)" on page 112).
3. From the Consistency Group tree, select a consistency group mode that includes the consistency group that you want to add.
4. From the Consistency Group list, select the consistency group(s) to add. Make sure to select more than one group that is not registered yet.
5. Right-click to display the pop-up menu, click **CT Group Operation**, and then click **Add CT Group**. The Add CT Group window is displayed.
6. From the Add CT Group window, select the port type (serial or fibre) and group options: copy pending timeout and RCU ready timeout. Remember that you will not be able to modify the port type of the group after you assign a pair to the group.
7. Click **Set** in the Add CT Group window. The Add CT Group window is closed and the list changes to the Consistency Group Settings Parameter list.



NOTE: The options can be modified and/or canceled after you have set them. See "[Modifying Parameters and Omitting Consistency Groups](#)" on page 113.

8. Click **Apply** on the TrueCopy main window.
9. If you are using TC390 Async in the n-to-1 configuration, reset the **Time Out (Copy Pending)** option as follows to avoid suspension of TC390 pairs due to timeout errors:
 - a. Suspend all pairs in the group so that you can change the group options.
 - b. Select the group on the Main window, select **Group Option**, change the **Time Out (Copy Pending)** option to **None**, and select **OK**.
 - c. Resume all pairs in the group, and then perform your normal TC390 Async operations.
 - d. Acquire the current TC390 async copy delay time by calculating the difference between the host I/O time-stamp information and the consistency time shown on the CT Group Status window.
 - e. Suspend all pairs in the group again and set the **Time Out (Copy Pending)** group option to a value greater than the current copy delay time. If the value exceeds the maximum time (15 min.), reduce the host I/O rate, or set the option to **None**.
 - f. Resume all pairs in the group.

Modifying Consistency Group Options (CT Group Option)

The **CT Group Option** command modifies the consistency group options you have set when the consistency group is added. When the **CT Group Option** command is selected, the CT Group Option window is

displayed. The CT Group Option window consists of the same boxes as the Add CT Group window (see ["Adding Consistency Groups \(Add CT Group\)"](#) on page 109).



NOTE: If you want to change the group options, you must split all pairs in the group first.

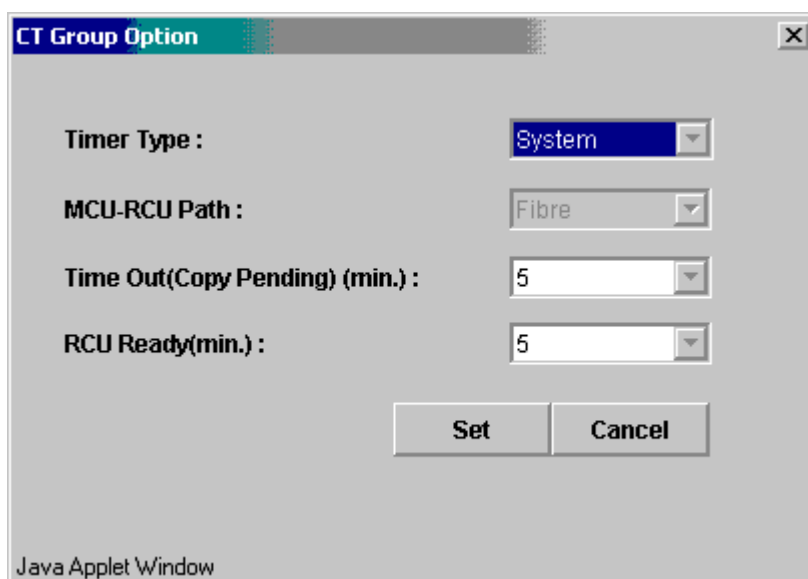


Figure 58 CT Group Option window

The **MCU-RCU Path** box indicates the selected port type (**Fibre**) for the remote copy connections. You cannot change the port type on the CT Group Option window.

For information about the boxes you can set on the CT Group Option window, see ["Adding Consistency Groups \(Add CT Group\)"](#) on page 109.

To change the group options:

1. Connect to the MCU.
2. Split all pairs in the group (Suspend Pair) so that you can change the group options.
3. From the Consistency Group tree, select a consistency group mode that includes the consistency group whose group option you want to modify.
4. From the Consistency Group list, select the consistency group(s) to modify the option. Make sure to select more than one consistency group whose This CU column indicates **MCU**.
5. Right-click to display the pop-up menu, click **CT Group Operation**, and then click **CT Group Option**. The CT Group Option window is displayed. If the **CT Group Option** command is not enabled, split the remaining pairs in this consistency group.
6. Change the group options as needed.
7. Click **Set** in the CT Group Option window. The CT Group Option window is closed and the list changes to the Consistency Group Settings Parameter list. The settings are applied to the list.



NOTE: The options can be modified and/or canceled after you have set them. See ["Modifying Parameters and Omitting Consistency Groups"](#) on page 113. However, Timer Type cannot be changed when there is a pair in concerned CT Group.

8. Click **Apply** on the TrueCopy main window.
9. When you are finished changing group options, resume all pairs in the group (Resume Pair).

Deleting Consistency Groups (Delete CT Group)

A consistency group can be deleted only from the MCU and only if the MCU does not contain any M-VOLs still assigned to the group. Deleting a consistency group from an MCU does not affect the consistency groups registered at other MCUs. The RCU will automatically delete a consistency group when the last volume pair in the group is deleted.

The **Delete CT Group** command deletes the selected group from the current MCU. You cannot delete a group that still has M-VOLs in the current MCU.

To delete a consistency group from an MCU:

1. Connect to the MCU.
2. From the **Consistency Group** tree, select a consistency group mode that includes the consistency group you want to delete.
3. From the Consistency Group list, select the consistency group(s) to delete. Make sure to select more than one consistency group whose This CU column indicates **MCU**.
4. Right-click to display the pop-up menu, click **CT Group Operation**, and then click **Delete CT Group**. The list changes to the Consistency Group Settings Parameter list. If the **Delete CT Group** command is not enabled, the selected group still contains M-VOLs in this MCU.



NOTE: The options can be modified and/or canceled after you have set them. See ["Modifying Parameters and Omitting Consistency Groups"](#) on page 113.

5. Click **Apply** in the TrueCopy main window to apply the deletion to the disk array.

Asynchronous Copy Option

Use the **Async Option** command to select the parameters for the TC390A copy operation. When the **Async Option** command is selected, the Async Option window is displayed. Use the Async Option window to specify the TC390A copy option parameters for the connected disk array. The async options apply to the entire physical control unit, including all TC390 M-VOLs and R-VOLs behind the control unit. The async options can be modified only when no TC390A pairs or groups exist in the connected CU (M-VOLs or R-VOLs).

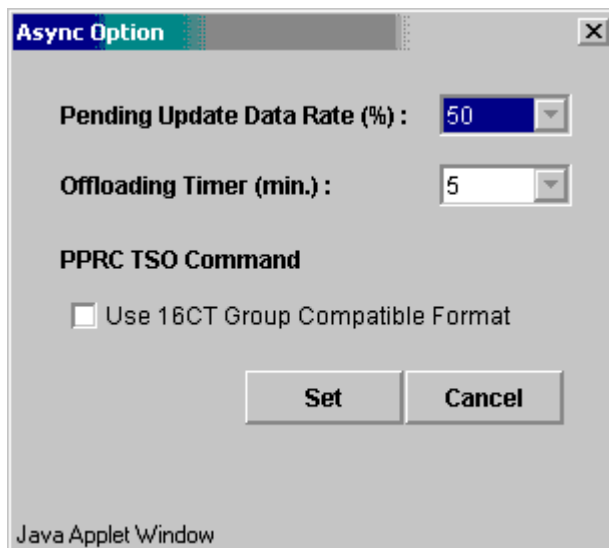


Figure 59 Async Option window

All the default settings indicate the current settings.

The **CLPR(#)** list specifies CLPR ID. The default setting is 00.

Use the **Pending Update Data Rate (%)** box to specify the TC390A (and CA Asynchronous) sidefile threshold that is the maximum amount of cache that can be used for storing TC390 (and CA) Async recordsets (sidefiles). You can select any value between 30% and 70% (10% increments) (see ["Inflow Control of Recordsets"](#) on page 40). The current pending update data rate is common to both TC390 and CA operations. The most recently entered value (on the TrueCopy or CA Async Option window) will be applied to TC390A and CA Asynchronous operations. When the amount of cache being used for TC390A and CA Asynchronous recordsets reaches the specified threshold value, the MCU/RCU performs cache inflow control as follows:

- The MCU's I/O response is delayed.
- The RCU accepts only the one specific recordset that will enable it to settle the pending recordsets in the queue(s). For all other recordsets the RCU responds to the MCU with the channel-command-retry request.



NOTE: If one or more consistency groups exist (TC390 or CA), this setting cannot be changed. This setting can be changed only when no consistency groups are assigned.

Use the **Offloading Timer (min.)** box to specify the amount of time, 0-20 minutes that the MCU will wait to send a TC390A recordset to the RCU. The MCU will suspend all affected TC390A volume pairs if it has not been able to offload a recordset to the RCU within the specified time (for example, the RCU is still responding channel-command-retry).

Use the **PPRC TSO Command** option to select the XP256-compatible format for PPRC TSO commands (see ["Using PPRC Commands for TrueCopy"](#) on page 160). This option should be selected only if you are using XP256 as RCUs connected to this XP128/XP1024/XP12000. The XP256 format limits PPRC operations to sixteen consistency groups (0-F). The disk array-compatible format (default) performs PPRC operations for all 128 consistency groups (00-7F) of the XP128/XP1024/XP12000.

To set the asynchronous option parameters:

1. From the Consistency Group list, right-click to display the pop-up menu and click the **Async Operation** command. The Async Option window is displayed.



NOTE: You do not have to select a consistency group on the list.

2. From the Async Option window, select the appropriate parameters.
3. Click **Set** to set the parameters. The list changes to the **Asynchronous Option Settings Parameter list**.



NOTE: The options can be modified and/or canceled after you have set them. See ["Modifying Parameters and Omitting Consistency Groups"](#) on page 113.

4. Click **Apply** on the TrueCopy main window to apply the option settings to the disk array.

Modifying Parameters and Omitting Consistency Groups

After the Consistency Group (CT Group) and/or Asynchronous Option operation, the parameters can be modified individually. Also the consistency groups that you have set by the operation can be omitted.

To modify the parameters:

1. After you have performed the **CT Group Operation**, select a consistency group whose parameters you want to modify on the list. To modify the parameters for **Async Option** operation, you do not have to select the row on the list.

2. Right-click to display the pop-up menu and click **Modify** to modify the parameters. A window for each operation is displayed.
3. Modify the parameters as needed and click **Set**.
4. Click **Apply** on the TrueCopy main window.

To omit the consistency groups: from the operation

1. Select the consistency groups to be omitted from the operation on the list.
2. Right-click to display the pop-up menu and click **Omit**. The Consistency Groups selected in [step 1](#) are deleted from the list and the deleted Consistency Groups have been removed from the operations.
3. Click **Apply** on the TrueCopy main window to apply the deletion to the disk array.

For the **CT Group Operation**, the **Cancel All** command deletes all the consistency groups on the list and all the consistency groups have been removed from the operations. All the consistency groups can also be deleted using the **Omit** command by selecting all of the consistency groups on the list. When all the consistency groups are deleted (by the **Cancel All** command or the **Omit** command), the list status becomes the Volume list.

For the Asynchronous Option operation, the Delete command is not available. You can either modify the options you have set or cancel all the option settings you made.



NOTE: After the delete operation of the **CT Group Operation** command, the **Modify** command is not available.

Usage Monitor Operations

Use the Usage Monitor window to perform the remote copy usage monitoring operations for the connected disk array. The remote copy usage monitoring function can collect I/O statistics for all LDEVs on the connected disk array.

The usage monitor operations are:

- Starting and stopping monitoring (see page 114)
- Displaying the usage monitor graph (see page 115)

Starting and Stopping Monitoring

At each data sampling time interval, the usage monitoring function collects 480 pieces of data for each LDEV and up to 16,385 pieces of data for the entire disk array.

To start monitoring:

1. From the Usage Monitor window, enter the sampling time interval in minute(s) in the **Rate** list. You can enter from 1 to 546 minutes. Entering more than five minutes is recommended.
2. Click **Run** in the **Operation** list.
3. Click **Apply**.

The collection of monitoring data continues, even if the window is closed, until you stop monitoring operations. Monitoring data collection continues even if the SVP is rebooted. If a monitor starts, the data of the sidefile usage is stored.

To stop monitoring:

1. From the Usage Monitor window, click **Stop** in the **Operation** list.
2. Click **Apply**. The monitoring process is stopped.

Displaying the Usage Monitor Graph

When usage monitoring is running, the Usage Operations window can display user-selected remote copy I/O statistics in real time. The I/O statistics data is collected according to the data-sampling rate selected in the Rate list.

The usage monitor graph plots the user-selected I/O statistics (up to 65 data points) on an x-y graph. The x-axis displays time and the y-axis displays the number of I/Os during the last sampling period. The legend is displayed on the right side of the graph. When the value for y-axis exceeds 10,000,000, the value is displayed in exponential notation. For example, $1E7 = 1 * 10^7 = 10,000,000$; $2E8 = 2 * 10^8 = 200,000,000$. The **Update** box displays the most recent data sample time for the data graph.

To display the usage monitor graph:

1. Verify that the usage monitoring is running. Status should be **Running**.
2. In the graph area of the Usage Monitor window, right-click to display the pop-up menu and click **Display Item**. The Display Item window is displayed.

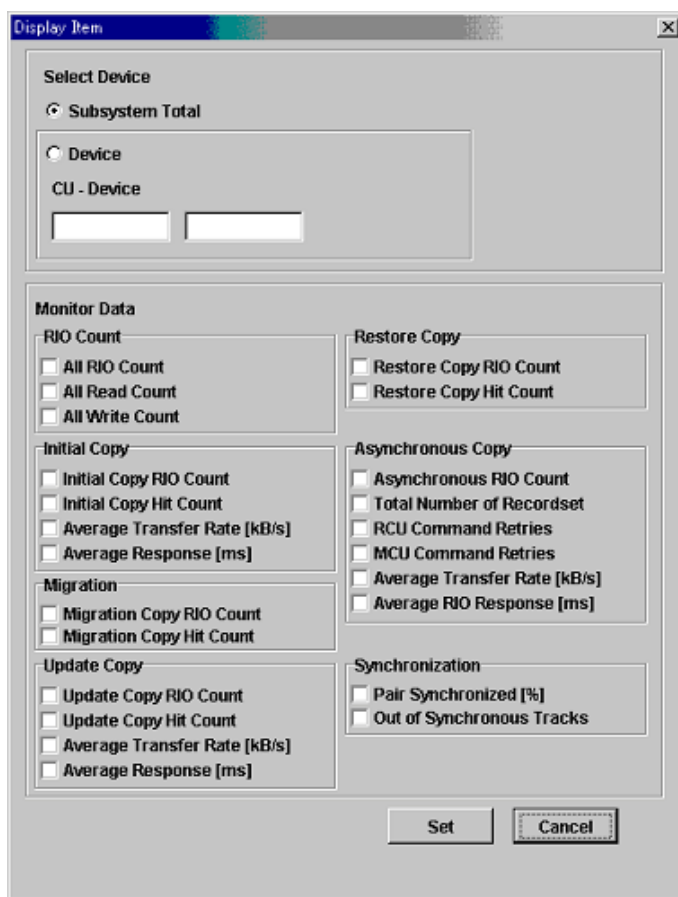


Figure 60 Selecting data for Usage Monitor Graph

3. In the **Select Device** box of the Display Item window, click one:
 - **Subsystem Total:** The I/O statistics data of all the LDEVs in the disk array is displayed.
 - **Device:** An LDEV of the CU image can be selected. In the **CU** box, 00-1F can be entered. In the **Device** box, 00-FF can be entered. If a device that is not installed is entered, the graph is not displayed.



NOTE: CU_LDEV is displayed on the top of the graph. If # is added to the end of an LDEV number, such as **3F#**, the LDEV is an external volume. For more information about external volumes, see ["HPAV for the XP128/XP1024/XP12000"](#) on page 351.

4. In the **Monitor Data** box of the Display Item window, select the I/O statistics data to display on the graph. More than one check box needs to be selected.
5. Click **Set** to close the Display Item window. The Usage Operations window now displays a graph showing the selected I/O statistics data for the selected LDEV(s).
To enlarge the displayed graph, right-click on the graph and click **Large Size**. To return the graph to normal size, right-click on the graph and click **Normal Size**.

To close the graph:

1. In the graph display area, right-click on the graph you want to close.
2. Click **Close** from the pop-up menu, or click **Close All** to stop displaying all the graphs. **A confirmation dialog box is displayed.**
3. Click **OK**.

Other methods of closing the graph:

- Select another tab.
- Select another program product or exit Command View.
- Select **Stop** in the **Operation** box of the Usage Monitor window and click **Apply**.

The following table lists and describes the I/O statistics that can be selected on the **Monitor Data** box of the Display Item window.

Table 18 I/O statistics

Statistic	Description
RIO count	
All RIO count	Total number of remote I/Os
All read count	Total number of remote read I/Os
All write count	Total number of remote write I/Os
Initial Copy	
Initial copy RIO count	Number of initial copy remote I/Os
Initial copy hit count	Number of initial copy hits
Average transfer rate (KB/S)	Average transfer rate (KB/sec) for initial copy remote I/Os
Average response (ms)	Average response time (msec) for initial copy remote I/Os
Migration Copy	
Migration copy RIO count	Number of migration copy remote I/Os
Migration copy hit count	Number of migration copy hits

Table 18 I/O statistics (continued)

Statistic	Description
Update Copy	
Update copy RIO count	Number of update copy remote I/Os
Update copy hit count	Number of update copy hits
Average transfer rate (KB/S)	Average transfer rate (KB/sec) for update copy remote I/Os
Average response (ms)	Average response time (msec) for update copy remote I/Os
Restore Copy	
Restore copy RIO count	Number of restore copy remote I/Os
Restore copy hit count	Number of restore copy hits
Async. Copy	
Async. RIO count	Number of asynchronous update copy remote I/Os
Total number of recordsets	Number of TC390A recordsets
RCU command retries	Number of command retries due to RCU channel-command-retry messages.
MCU command retries	Number of command retries due to MCU SCP messages.
Average transfer rate (kB/sec)	Average transfer rate (kB/sec) for TC390/TC async update copy remote I/Os
Average RIO response (ms)	(Total RIO process time on a subsystem or selected volume for a certain interval period) / (Asynchronous RIO count); where RIO process time = time between the asynchronous data transfer request and the actual transfer of the recordset(s) to the RCU.
Synchronization	
Pair Synchronized (%)	Percent completion of the initial copy operation (number of synchronized pairs / total number of pairs). For <i>duplex</i> TC390 Synchronous pairs, this value is always 100% after the initial copy operation is complete.
Out of Sync Tracks	Number of tracks that have not yet been copied by the initial copy or resync copy operation (this applies only when suspended during initial copy or during resync copy).



NOTE: Migration Copy and Restore Copy apply only to internal use. All other RIO statistics include both TC390 and TC remote copy operations (async RIO count = TC390A RIOs + TCA RIOs). However, Synchronization is not supported for this version.

Script Operations

At this time, exporting script trace files is not supported. For more information about the Script Operations window, refer to ["Script Operations Window"](#) on page 84.

History Operations

At this time, exporting history files is not supported. For more information about the History window, refer to ["History Window"](#) on page 86.

Other Operations

Click the **Clear SIM** button on the Other Operations window to clear all remote copy SIMs (service information messages) from the connected disk array. Remote copy SIMs include all SIMs issued for TC390 and CA operations.

The clear SIM function is intended for use during disaster recovery operations, while switching operations to the remote (secondary) backup site. Please see ["Switching Operations to the Remote Site"](#) on page 149 for specific instructions on clearing remote copy SIMs during disaster recovery operations.

To clear all remote copy SIMs from the disk array:

1. Click the **Other Operations** tab, and then click **Clear SIM**.
2. From the Clear SIM confirmation window, click **Yes** to clear all remote copy SIMs from the connected disk array, or click **No** to cancel your request to clear SIMs.
3. If you clicked **Yes**, the disk array verifies that the existing SIMs are being cleared.

Optimizing TrueCopy Operations and Disk Array Performance

All TC390 operations result in increased utilization of the disk array's channel resources because of the additional write (remote copy) operations to the secondary volumes. The TC390 update copy mode (synchronous or asynchronous) determines exactly how the remote copy operations will impact disk array performance as follows:

- **Synchronous** copy mode (TC390 Synchronous) has an additional effect on disk array performance: increased service and disconnect time for write I/Os to TC390 M-VOLs due to the delay between channel-end and device-end. The length of this delay increases as the distance between the M-VOL and R-VOL increases so that the longest delay occurs when the main and remote volumes are the maximum distance apart.
- **Asynchronous** copy mode (TC390A) eliminates all delays associated with TC390 Synchronous operations while providing increased protections for write-dependent applications in the event of a disaster. Write I/Os for TC390A M-VOLs are processed in the same way as writes for simplex volumes, without any increase in service or disconnect time. The asynchronous R-VOL updates are performed completely independent of all host I/O processes at the M-VOLs and there are no restrictions on subsequent read/write operations to TC390A M-VOLs. The only performance concerns for TC390A are ensuring that adequate cache resources are available for sidefiles that are used to store the recordsets at both the MCUs and RCUs, and ensuring that sufficient ESCON paths are defined for copy operations.

In addition to the TC390 update copy mode, several other factors can also affect XP128/XP1024/XP12000 performance. You can optimize both the TC390 operations and the I/O performance of the disk arrays by analyzing workloads and addressing system-level conditions (for example, number of ESCON paths) that can affect disk array performance. You can also control the impact of TC390 operations on disk array performance by selecting the appropriate RCU options for each MCU (see ["Registering an RCU \(Add RCU\)"](#) on page 93) and the appropriate update copy mode (synchronous or asynchronous) and pair options (see ["Creating TrueCopy Volume Pairs \(Add Pair\)"](#) on page 126) for each TC390 pair. In addition, you can upgrade the TC390 hardware components and/or adjust the configuration of the components to improve disk array performance under a wide range of

operating conditions. The following table lists some of the conditions that affect disk array performance and provides recommendations for addressing these conditions.

Table 19 Optimizing TrueCopy operations and XP128/XP1024/XP12000 performance

Condition	Description	Recommendation(s)
Write-intensive workloads	Write-intensive workloads, such as SPOOL volumes and database logging volumes, can have a significant impact on disk array I/O response times.	Spread write-intensive data across several volumes to minimize queuing. Also consider increasing the duplex write line (DWL) of the disk array using Performance Manager.
Large block size	Workloads with large write block sizes, such as DB2 deferred writes, can impact performance.	Spread workloads with large write block sizes across several volumes.
High host channel demand	The demand on the MCU's host channels can affect performance.	Spread the workload across several disk arrays to use additional channels.
Sequential write operations	TC390 operations can have a negative impact on workloads with a high percentage of sequential write operations, such as batch processing operations (for example, dump/restore or sort operations).	Avoid performing restore operations to volumes that belong to TC390 pairs. Instead, restore data to a scratch volume and then establish the TC390 volume pair.
Cache size	Large cache size improves read hit performance, which allows more disk array resources to be devoted to write operations. The resulting performance improvement can offset some or all of the performance loss due to the TC390 remote copy operations. TC390A and HXRC require additional cache for sidefile data. Insufficient cache resources can result in command retries, SCP notifications, and puncture conditions.	Consider increasing the cache size of the TC390 disk arrays to handle TC390A and HXRC sidefile operations and to improve overall disk array performance. For best results, the cache and NVS capacity of the main and remote disk arrays should be the same (for TC390A the RCU sidefile requirements are 2x that of the MCU) to enable the remote site to function adequately during disaster recovery.
RCU capacity	The performance of the RCUs directly affects the performance of the MCUs. If an RCU becomes overloaded with heavy update activity, MCU and system performance can also be degraded.	Distribute TC390 remote copy operations among several remote disk arrays to avoid overloading any one RCU.
ESCON paths	An inadequate number of ESCON paths may decrease disk array performance. Performing TC390 Synchronous operations over long distances can also degrade disk array performance. TC390A is recommended for long distances.	Make sure to install an adequate number of ESCON paths between the main and remote disk arrays. This is especially important for disk arrays that contain both M-VOLs and R-VOLs.

Discontinuing TrueCopy Operations

If you plan to use TC390 for nondisruptive data migration or duplication (see "[ICKDSF Considerations for TrueCopy Volumes](#)" on page 142), you will need to configure and establish TC390 operations, allow TC390 to synchronize the volumes, redirect application I/Os (if migrating), and then discontinue TC390 operations. When you are ready to discontinue TC390 operations, you will need to perform TC390

operations in the correct order to avoid generating error messages. For example, you cannot delete an RCU path until you have deleted all TC390 pairs still using that path and you cannot delete a group until you have deleted all TC390A pairs in that group.

To discontinue all TC390 operations:

1. Delete all TC390 pairs from the MCU(s) (Delete Pair, see ["Deleting TrueCopy Volume Pairs \(Delete Pair\)"](#) on page 137). For TC390A pairs, you can use the **Delete Range-Group** option to delete all pairs in a group using just one operation. Verify that the pair status has changed to Simplex for all TC390 volumes before continuing.
2. Delete the TC390A group(s) from the MCU(s) (see ["Deleting Consistency Groups \(Delete CT Group\)"](#) on page 112). The RCU will automatically delete a group when all pairs in the group have been deleted.
3. Delete the RCUs (see ["Deleting an RCU \(Delete RCU\)"](#) on page 101). Check each CU image of each MCU to verify that all RCUs have been deleted before continuing.
4. Remove the remote copy connections (physical paths). If you are not familiar with the operation of the remote copy hardware components (for example, ESCON directors, repeaters, and switches), call HP technical support for assistance.
5. For serial interface, reset the RCP(s) to LCP(s) at the MCU(s). For Fibre Channel interface, reset the initiator port(s) to ordinary target(s) at the MCU(s).

Performing TrueCopy Pair Operations

Preparing for TrueCopy Volume Pair Operations

Before starting TC390 operations, you must consider the relative importance of disk array I/O performance and disaster recovery preparation. As described in ["Optimizing TrueCopy Operations and Disk Array Performance"](#) on page 118, remote copy operations can affect the I/O performance of the MCUs and RCUs. TC390 provides many options, such as initial copy options, pair options, group options, and async options, that controls the impact of TC390 operations on I/O performance. These options can be set separately for each pair, for each TC390A group, and for each MCU to provide maximum flexibility. You can select options that minimize the impact of TC390 operations on disk array performance, or options that maximize the effectiveness of TC390 operations to ensure the best level of backup data integrity. System-level factors (for example, number of paths) can also affect TC390 operations and disk array performance (see [Table 19](#) on page 119).

For TC390 disaster recovery operations, you should verify that the RCUs are attached to a host server to enable reporting of sense information and transfer of host failover information. If the remote site is unattended, attach the RCUs to a host server at the main site so that the system administrator can monitor the operational condition of the RCUs.

To prepare for TC390 volume pair operations, you need to identify the volumes by LDEV ID for which you want to establish TC390 remote copy operations. You should identify volumes that are required for system operation as well as volumes that contain important data to be backed up (for example, DB log files). Copying these volumes to the remote site will enable faster disaster recovery than maintaining a current version of these files at the remote site. For large databases that span multiple volumes, you should plan to establish a TC390A consistency group for each database so that the update sequence consistency of the database can be ensured at the remote site.

You can start creating the TC390 volume pairs as soon as you have:

- Identified the volumes that will become the TC390 M-VOLs (and R-VOLs)
- Ensured that all system and TC390 requirements have been met (see ["System Requirements"](#) on page 53 and ["Requirements and Restrictions"](#) on page 54)

- Completed hardware and software installation (see ["Installing the TrueCopy Hardware"](#) on page 57 and ["Installing the TrueCopy Software"](#) on page 62)
- Configured the MCUs and RCUs for TC390 operations (see page 62)



NOTE: TC390 and SI390 can function together in the same XP128/XP1024/XP12000 to provide both internal and remote backup for your data. If you are planning to combine TC390 and SI390, read the important configuration information in ["Combining TrueCopy with Other Data Management Operations"](#) on page 66.

If you will be using the TC390 software to perform remote copy operations, the management station must be LAN-attached to the MCU of each TC390 volume pair. You should also install and attach a management station to the RCUs at your remote site. If you will be using PPRC commands instead of Command View, contact your HP account support representative for information on TC390 configuration services. The following TC390 operations cannot be performed using PPRC commands: asynchronous options, group addition/deletion, and group options. For more information on using PPRC commands with the XP128/XP1024/XP12000, see ["Using PPRC Commands for TrueCopy"](#) on page 160.

Common Procedure for TrueCopy Pair Operation

From the Pair Operations window (see ["TrueCopy Main Window \(Pair Operations Window\)"](#) on page 74), you can perform the pair setting operations. All the operations that can be performed from the Pair Operations window have a common procedure.

To perform the pair settings operation:

1. Select a CU number in the CU Number tree.



NOTE: A CU number must be selected in the tree.

2. Select one or more devices or pairs in the Volume list.
3. Right-click to display the pop-up menu (see [Figure 61](#)). The pop-up menu consists of the following:
 - **Pair Status:** Displays the volume status (see ["Viewing the Status of TrueCopy Volume Pairs \(Pair Status\)"](#) on page 123).
 - **Add Pair:** Creates a volume pair using the following commands: **Synchronous** and **Asynchronous** (see ["Creating TrueCopy Volume Pairs \(Add Pair\)"](#) on page 126).
 - **Delete Pair:** Deletes the pairs (see ["Deleting TrueCopy Volume Pairs \(Delete Pair\)"](#) on page 137).
 - **Suspend Pair:** Splits (Suspends) the pairs (see ["Suspending TrueCopy Pairs \(Suspend Pair\)"](#) on page 132).
 - **Resume Pair:** Resumes the pairs (see ["Resuming TrueCopy Volume Pairs \(Resume Pair\)"](#) on page 134).
 - **Change Pair Option:** Changes the pair option (see ["Changing the Pair Options \(Change Pair Option\)"](#) on page 140).

- **Snapshot:** Creates the snapshot file (see ["Snapshot Function"](#) on page 78).

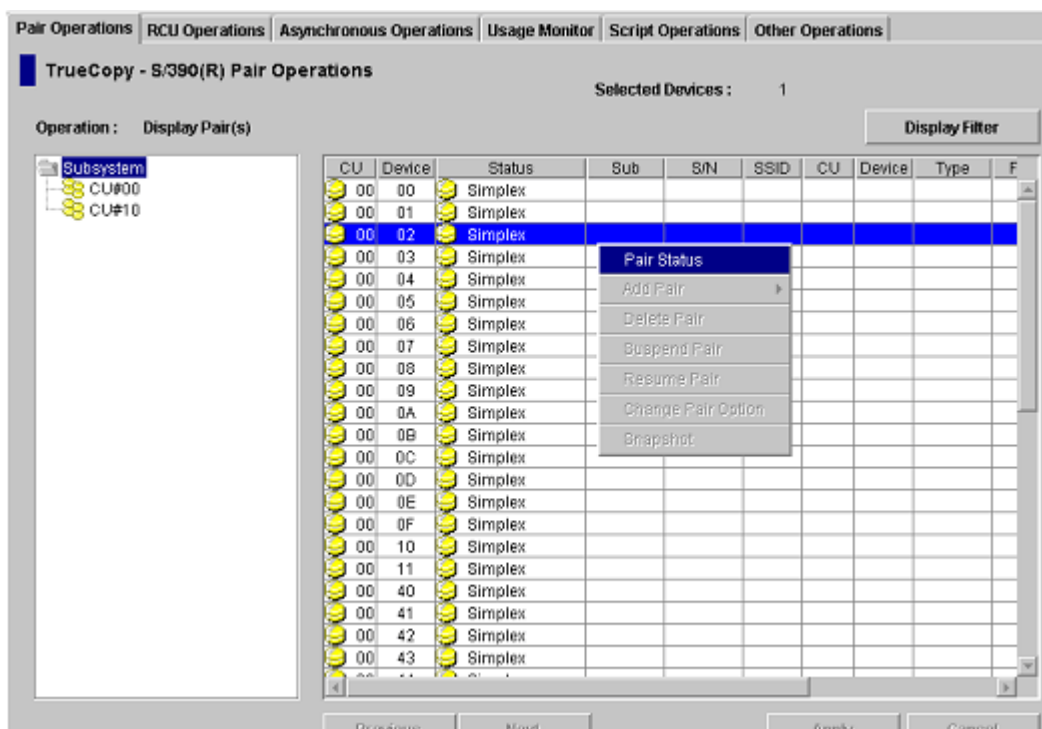


Figure 61 TrueCopy main window (Pair Operations window)

4. Select a command and use the window to make your settings.
5. Click **Set**.



NOTE: The options can be modified and/or canceled after you have set them. See ["Modifying Parameters and Omitting Selected Volumes"](#) on page 122.

6. Click **Apply** on the TrueCopy main window.

The status of the command (active or inactive) depends on the status of the volumes selected in the Volume list.

The following sections describe in detail for each command and operation.

List after the Command Selection

After the window is closed, only the Volumes selected in [step 2](#) of the procedure described in the ["Common Procedure for TrueCopy Pair Operation"](#) on page 121 are displayed in the list. The items of the list are also changed. The Volume list that is in this status is called the Pair Settings Parameter list. The items of the Pair Settings Parameter list depend on the command selected from the pop-up menu and the operation you performed. The items for each command are described in the sections.

Use the **Set** button on each parameter window to preset the parameters to the Pair Settings Parameter list. To apply the parameters to the system, click **Apply** on the TrueCopy main window.

The **Cancel** button closes the window, but does not set the parameters. The **Cancel All** button returns you to the Volume list.

Modifying Parameters and Omitting Selected Volumes

After the pair settings operation, the volume parameters can be modified individually. Also the volumes that are selected to be the pairs can be omitted from the pair operation.

To modify the parameters of a volume:

1. Select a volume whose parameters to be modified on the **Pair Settings Parameter list**.
2. Right-click to display the pop-up menu and click **Modify** to modify the parameters. A window is displayed.
3. Modify the parameters and click **Set**.
4. Click **Apply** on TrueCopy main window.

To omit the selected volumes:

1. Select the volumes to be omitted from the operation on the **Pair Settings Parameter list**.
2. Right-click to display the pop-up menu and click **Omit**. The volumes selected in [step 1](#) are deleted from the **Pair Settings Parameter list** and the deleted volumes have been removed from the pair settings operations.
3. Click **Apply** on the TrueCopy main window.

The **Cancel All** command deletes all the volumes listed on the **Pair Settings Parameter list** and all the volumes have been removed from the pair settings operations. All the volumes can also be deleted from the list using the **Omit** command by selecting all of the volumes on the **Pair Settings Parameter list**. When all the volumes are deleted from the list (by the **Cancel All** command or the **Omit** command), the list status becomes the Volume list.

Viewing the Status of TrueCopy Volume Pairs (Pair Status)

The **Pair Status** command can be used to display the TC390 pair status information in detail.

To display the TC390 pair status information:

1. From the tree, select **Display All** or a **CU number**. The **Pair Status** command can be selected when **Display All** or **CU number** is selected in the tree.
2. From the Volume list, select a volume whose pair status information to be displayed.

3. Right-click and click **Pair Status** from the pop-up menu. The Pair Status window is displayed.

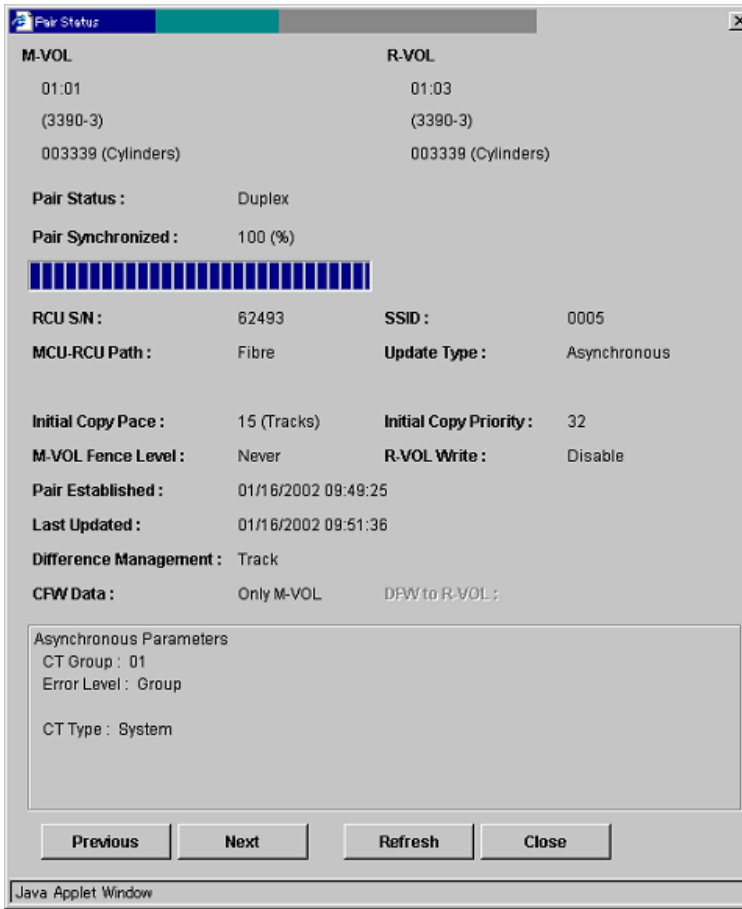


Figure 62 Pair Status window

- **M-VOL** and **R-VOL**: The first row: CU number and Device ID. The second row: Device emulation type. The third row: Capacity (number of cylinders).
 - The CLPR number and CLPR name are not displayed under R-VOL.



NOTE: If # is added to the end of an LDEV number, such as **00:3F#**, the LDEV is an external volume. For more information about external volumes, see the [“HPAV for the XP128/XP1024/XP12000”](#) on page 351.

- **Pair Status**: Simplex, Pending, Duplex, Suspended, Suspending, Deleting, Suspended (Continue), or Suspending (Continue). For more information for TC390 pair status, see [“TrueCopy Volume Pair Status”](#) on page 46. If the pair is split or suspended, the split/suspended type is also displayed.
- **Pair Synchronized**: Displays how far the initial copy operation progressed in percentage and the progress bar.
- **RCU S/N** and **SSID**: Serial number and SSID of the RCU (or MCU if R-VOL is selected).
- **MCU-RCU Path**: Channel type of the path interface between the disk arrays (Serial or Fibre).
- **Update Type**: Synchronous or Asynchronous.
- **Initial Copy Pace**: 3 tracks or 15 tracks (displayed during initial copy and resume copy).
- **Initial Copy Priority**: 1 - 256 (displayed during initial copy and resume copy).

- **M-VOL Fence Level:** Conditions under which the MCU will reject write operations to the M-VOL. **Never:** Never fence the operation. **Data:** Fence when the MCU cannot successfully execute an update copy operation for any reason. **Status:** Fences only if the MCU is not able to change the R-VOL status to the same status as the M-VOL.
- **R-VOL Write:** Enabled (Write operation to the R-VOL is enabled) or disabled (Write operation to the R-VOL is disabled) for this pair. The Write operation to the R-VOL is enabled only when the Asynchronous pair is split. However, Enabled is not usually recommended. When R-VOL Write Enabled is required, contact your HP account support representative.
- **Pair Established:** The date and time that the volume pair was created.
- **Last Updated:** The date and time that the volume pair status was last updated.
- **Difference Management:** **Auto**, **Cylinder**, or **Track**.
- **CFW Data:** The **CFW Data** option specifies whether the CFW data will be copied to the R-VOL:
 - If **Copy to R-VOL** is selected, the MCU will copy the CFW data to the R-VOL.
 - If **Only M-VOL** is selected, the MCU will not copy the CFW data to the R-VOL. This setting is recommended for two reasons: (1) copying the CFW data impacts disk array performance and (2) CFW data is typically used for temporary files (for example, sort work datasets) that are not usually required for disaster recovery.



NOTE: If a TC390 pair is established using PPRC commands, the CFW data option is set to the **Copy to R-VOL** setting.

- **DFW to R-VOL:** The **DFW to R-VOL** option (TC390 Synchronous only) specifies whether the MCU will suspend a TC390 volume pair when the RCU cannot execute DFW to the R-VOL:
 - If **DFW not required** is selected, the MCU will not suspend the TC390 volume pair when DFW on the RCU is blocked. This option is recommended if you need to maintain synchronization of the TC390 volume pair.



NOTE: If a TC390 pair is established using PPRC commands, the **DFW to R-VOL** option is set to **not required**.

- If **DFW required** is selected, the MCU will suspend the pair when DFW on the RCU is blocked. This option is recommended if you need to maintain high MCU I/O performance.



CAUTION: The interaction of the **DFW required** setting and the M-VOL fence level setting can cause a host application to fail with a permanent I/O error when attempting to update an M-VOL. Keep track of which volume pairs have the **DFW required** setting and verify that the DFW to the R-VOL is not blocked.



NOTE: The DFW to R-VOL setting does not affect the I/O performance of the M-VOLs. If one side of cache is closed due to an RCU failure, the TC390 copy operation still uses DFW. The only difference between **not required** and **required** is that new pairs cannot be established with the **DFW-to-R-VOL required** option when one side of RCU cache is closed (the add pair operation fails).

- **Asynchronous Parameter** box consists of the following:
 - **CT Group:** Consistency group to which the TC390A pair is assigned.

- **Error Level:** Error level for the TC390A pair(s)
- **C/T Type:** Timer type of the consistency group (System, Local or None).
- **Consistency time:** Consistency time of the group to which the TC390A pair is assigned
- **SEQCHK:** Displayed when the TC390A pair has the *SEQCHK* status. This status is managed by the RCU and the MCU may not have the most current information. Always use the R-VOL pair status information displayed at the RCU for disaster recovery.
- The **Previous** button changes the displayed pair status information to that of the previous Volume on the Volume list (the Volume of the row above). The **Next** button changes the displayed pair status information to that of the next Volume on the Volume list (the Volume of the row below). The **Refresh** button refreshes the pair status information. The **Close** button closes the Pair Status window.



NOTE: The Display Filter settings can affect how Previous or Next is recognized.

The Volume list can display 256 rows at once. Therefore, the **Previous** and the **Next** buttons can be used to display the 256 rows at once.

Creating TrueCopy Volume Pairs (Add Pair)

The **Add Pair** command creates one or more new TC390 pairs. When the **Add Pair** command is selected, the Add Pair window is displayed. Use the Add Pair window to select the R-VOL, RCU, and initial copy options for the pair(s) being created.



NOTE: Make sure to select the appropriate CU image before creating any TC390 pairs.

Figure 63 Add Pair (Synchronous) window

Figure 64 Add Pair (Asynchronous) window



NOTE: When you set the several pairs at once and you want to keep some of the individual settings, leave the parameter box blank. Then, only the parameters you enter are available.

- **M-VOL:** Device ID of the M-VOL.



NOTE: If # is added to the end of an LDEV number, such as **00:3F#**, the LDEV is an external volume. For more information about external volumes, see [“HPAV for the XP128/XP1024/XP12000”](#) on page 351.

- **R-VOL:** Select the R-VOL device ID for the specified M-VOL. If you selected more than one volume, R-VOLs will automatically be assigned to the rest of the selected M-VOLs based on device ID. For example, if you select three volumes on the Volume list and select LUN01 as R-VOL for the first M-VOL, R-VOLs of the following M-VOLs are LUN02 and LUN03.



NOTE: Verify all the assigned R-VOLs are available. If the automatically assigned R-VOLs are already used for the other operation, you have to modify the R-VOL individually (see [“Modifying Parameters and Omitting Selected Volumes”](#) on page 122 for instructions).

- **RCU:** Select an RCU (Serial number, CU number, SSID, and Port type) for the TC390 pair(s) being created. The RCUs that are already registered can be selected from the list. The RCU must be the same for all pairs being created during this operation.
- **M-VOL Fence Level:** The **M-VOL Fence Level** option (TC390 Synchronous only) specifies the conditions under which the MCU will reject write operations to the M-VOL, which is known as “fencing.” This option is very important for disaster recovery planning (see [“Considering the M-VOL Fence Level Setting”](#) on page 147). TC390A M-VOLs are never fenced.

- If **Data** is selected, the M-VOL will be fenced when the MCU cannot successfully execute an update copy operation for any reason. This setting is functionally equivalent to the CRIT(YES-ALL) parameter for the CESTPAIR command.
- If **Status** is selected, the M-VOL will be fenced only if the MCU is not able to change the R-VOL pair status to suspended when an update copy operation fails. If the MCU changes the R-VOL pair status to suspended, subsequent write operations to the M-VOL will be permitted and the MCU will keep track of all updates to the M-VOL while the pair is suspended. This setting is functionally equivalent to the CRIT(YES-PATHS) parameter for the CESTPAIR command.
- If **Never** is selected, the M-VOL will never be fenced. If the TC390 volume pair is suspended, write operations to the M-VOL will be accepted. This setting is functionally equivalent to the CRIT(NO) parameter for the CESTPAIR command.
- **Initial Copy Parameters:** Select the initial copy options.
- **Initial Copy.** This option specifies the initial copy mode for the new pair(s).

If **Entire** is selected, the initial copy operation will copy all cylinders on the M-VOL (except diagnostic and unassigned alternate tracks) to the R-VOL. This setting is functionally equivalent to the MODE=COPY parameter for the CESTPAIR command.

If **No Copy** is selected, the initial copy operation will not be performed. The MCU will begin performing update copy operations as needed. This setting is functionally equivalent to the MODE=NOCOPY parameter for the CESTPAIR command.



CAUTION: The user must ensure that the M-VOL and R-VOL are already identical when using this setting.

- The **Initial Copy Pace** option specifies the maximum number of tracks that can be copied at one time by the TC390 initial copy operation before the MCU accepts another host request:

The **15 Tracks** setting speeds up the initial copy operation, but may affect the disk array's I/O performance if the M-VOL is experiencing high write I/O activity. This setting is functionally equivalent to the PACE=2-255 parameter for the CESTPAIR TSO command.

The **3 Tracks** setting slows down the initial copy operation to minimize the impact of the initial copy operation on the disk array's I/O performance. This setting is functionally equivalent to the PACE=1 parameter for the CESTPAIR command.

- **Priority (From 1 to 256):** The initial copy priority specifies the order in which the initial copy operations will be performed if the number of requested initial copy operations is greater than the maximum initial copy activity setting on the RCU Option window (see "[Registering an RCU \(Add RCU\)](#)" on page 93). The highest priority is 1 and the lowest priority is 256 (current default = 32). The TC390 initial copy priority option can be used to spread initial copy operations across disk array groups and/or disk array domains (ACP pairs) to reduce initial copy time as well as host I/O contention.

Example: The maximum initial copy activity setting is 4 and you add 6 TC390 pairs at the same time (for LDEVs 00 through 05) with the initial copy priority set as follows:

M-VOL of TC390 pair	Priority
LDEV 03	1
LDEV 05	2
LDEV 00	3

M-VOL of TC390 pair	Priority
LDEV 04	4
LDEVs 01, 02	5

The MCU will start the initial copy operations for LDEVs 03, 05, 00, and 04 immediately, then start LDEV 01 when one of the first four initial copy operations is complete, and then start LDEV 02 when the next initial copy operation is complete. If additional TC390 pairs are added, the MCU also prioritizes the initial copy operations by time requested so that all TC390 pairs in the first group are started before any pair in the next group is started.



NOTE: The CESTPAIR TSO command does not support the initial copy priority option. When CESTPAIR is used to establish TC390 pairs, the initial copy operations are performed in the order that the CESTPAIR commands are issued.

- **Difference Management:** Select **Auto**, **Cylinder**, or **Track** as the basis for managing the differential data. The default is **Auto**. When you select **Auto**, either **Cylinder** or **Track** is selected depending on the basic size of the logical volume image.
- The **CFW Data** option specifies whether the CFW data will be copied to the R-VOL:

If **Copy to R-VOL** is selected, the MCU will copy the CFW data to the R-VOL.

If **Only M-VOL** is selected, the MCU will not copy the CFW data to the R-VOL. This setting is recommended for two reasons: (1) copying the CFW data impacts disk array performance and (2) CFW data is typically used for temporary files (for example, sort work datasets) that are not usually required for disaster recovery.



NOTE: If a TC390 pair is established using PPRC commands, the CFW data option is set to the **Copy to R-VOL** setting.



NOTE: By using Remote Copy Function Switch, you can set the following option with CESTPAIR: CFW data = only M-VOL. If you want to use this function, please contact your HP account support representative.

- The **DFW to R-VOL** option (TC390 Synchronous only) specifies whether the MCU will suspend a TC390 volume pair when the RCU cannot execute DFW to the R-VOL:

If **DFW not required** is selected, the MCU will not suspend the TC390 volume pair when DFW on the RCU is blocked. This option is recommended if you need to maintain synchronization of the TC390 volume pair.



NOTE: If a TC390 pair is established using PPRC commands, the **DFW to R-VOL** option is set to **not required**.

If **DFW required** is selected, the MCU will suspend the pair when DFW on the RCU is blocked. This option is recommended if you need to maintain high MCU I/O performance.



CAUTION: The interaction of the **DFW required** setting and the M-VOL fence level setting can cause a host application to fail with a permanent I/O error when attempting to update an M-VOL. Keep track of which volume pairs have the **DFW required** setting and verify that DFW to the R-VOL is not blocked.



NOTE: The DFW to R-VOL setting does not affect the I/O performance of the M-VOLs. If one side of cache is closed due to an RCU failure, the TC390 copy operation still uses DFW. The only difference between **not required** and **required** is that new pairs cannot be established with the **DFW-to-R-VOL required** option when one side of RCU cache is closed (the add pair operation fails).

- **Asynchronous Parameters:** Can be selected only for the Asynchronous pair(s).
 - **CT Group: C/T Group.** This option specifies the consistency group for the pair(s) being added (TC390A only). All TC390A pairs must be assigned to a consistency group.



NOTE: Only TCzA pairs belonging to the same CLPR can be allocated to one consistency group. For more information about CLPRs, see the *HP StorageWorks Command View XP for XP Disk Arrays User Guide*.



NOTE: The CESTPAIR command can be used to start TC390A pairs and assign them to groups, but the groups must already be configured (using the Add C/T Group window, see [“Adding Consistency Groups \(Add CT Group\)”](#) on page 109).

- The **Error Level (Async)** option (TC390A only) specifies the error level for the TC390A pair(s):

Group: When the specified pair is suspended, all TC390A pairs in the same consistency group will be suspended, even if the failure affects only that pair and not the entire group.

Select the **Group** error level for all TC390A volumes that are essential to disaster recovery. Suspended TC390A R-VOLs that have the **Volume** error level should not be used for disaster recovery.

Volume: If the failure affects only the specified pair, then only that pair will be suspended. A failure that affects an entire group will always result in the suspension of all pairs in the group, as well as all other affected TC390 pairs.



NOTE: You can also use the CESTPAIR TSO command to specify the error level for TC390A pairs (see [“Using PPRC Commands for TrueCopy”](#) on page 160).

The **Pair Resume (Async)** option (TC390A only) is available only when the Pair Option window is opened during the resume TC390A pair operation (see [“Resuming TrueCopy Volume Pairs \(Resume Pair\)”](#) on page 134). Use the TC390A **Group** resume option to resume all suspended TC390A pairs in a group. Use the TC390A **Volume** resume option to resume only the selected TC390A pair(s).

- The **Cancel** button cancels the settings you have made and closes the Add Pair window. The **Set** button sets the parameters and closes the Add Pair window.

When you are creating two or more pairs at the same time, the initial copy options will be the same for all the pairs. You can modify these initial copy options for individual pairs as needed. The procedure to modify the options, see [“Modifying Parameters and Omitting Selected Volumes”](#) on page 122.

To create one or more new TC390 volume pairs:

1. Verify that the volumes that will be the TC390 R-VOLs are offline from all hosts.
2. Connect to the disk array that contains the M-VOLs of the pair(s) you are creating and start the TC390 software. The RCPs or Initiator ports must be configured (see ["Configuring the Host Interface Ports"](#) on page 90) and the RCU(s) must be registered already (see ["Registering an RCU \(Add RCU\)"](#) on page 93).
3. From the CU Number tree on the TrueCopy main window, select the CU number.
4. From the Volume list on the TrueCopy main window, select the volume(s) that will be the M-VOL(s) of the TC390 volume pair(s). You can select one or more volumes and establish one or more pairs at a time only if the R-VOLs are in the same RCU and the pairs will have the same copy mode (Sync or Async). You cannot start TC390 Sync and TC390A pairs at the same time.
5. Right-click to display the pop-up menu, click **Add Pair**, and click the pair mode (**Synchronous** or **Asynchronous**). The Add Pair window is displayed.



NOTE: Pair mode specifies the update copy mode (see ["Update Copy Operations"](#) on page 36) for the new pair(s): **Synchronous** or **Asynchronous**. The selection of mode has the greatest impact on performance and must be considered carefully. Factors in mode selection include (but are not limited to) the use of TC390 (for disaster recovery or migration), the number of pairs, and the write I/O activity to the M-VOLs.

6. From the Add Pair window, enter the R-VOL for the pair, select the RCU, and select the initial copy options for the pair(s) being created (see ["Creating TrueCopy Volume Pairs \(Add Pair\)"](#) on page 126).
7. Click **Set** to close the Add Pair window and set the parameters.
The list changes to the Pair Settings Parameter list (Add Pair). The Pair Settings Parameter list (Add Pair) is updated by the parameter settings and displays all pairs being created. The initial copy options and pair options you selected are applied to all pairs, but you can modify the options for each pair individually as needed (see ["Modifying Parameters and Omitting Selected Volumes"](#) on page 122).
8. From the Pair Settings Parameter list (Add Pair), check the RCU S/N and SSID, R-VOL, and copy options for each pair. You can modify the options as needed (see ["Modifying Parameters and Omitting Selected Volumes"](#) on page 122). Verify that all TC390 options for each new pair are correct.
9. If you want to execute the Add Pair requests quickly, select the **Use Time-Saving Mode** check box above the Pair Settings Parameter list (Add Pair).
10. Click **Apply** on the TrueCopy main window to create (start) the specified TC390 pair(s). The MCU will start the initial copy operations according to the initial copy priority and the maximum initial copy activities setting of the RCU.
11. From the TrueCopy main window, verify that the new TC390 pair(s) is/are displayed correctly (Pending status) in the Volume list. To monitor the status of the new pair(s), click **Refresh** to update the information in the Volume list or use the Pair Status window (see ["Viewing the Status of TrueCopy Volume Pairs \(Pair Status\)"](#) on page 123) to monitor the detailed status of each pair.



NOTE: The Add Pair operation will be rejected if the M-VOL is in the correction access or correction copy state. If this occurs, wait for the volume state to change and then repeat this procedure. If the status is not displaying correctly, verify that the correct CU image is selected. For information on troubleshooting suspended pairs, see ["General TrueCopy Troubleshooting"](#) on page 153.



CAUTION: If a timeout error occurs after clicking the **Use Time-Saving Mode** option, confirm on the TrueCopy main window for which volumes the Add Pair operation could not be performed. Deselect the **Use Time-Saving Mode** option for the failed volumes and retry the Add Pair operation.

Suspending TrueCopy Pairs (Suspend Pair)

The **Suspend Pair** command suspends TC390 pairs. When the **Suspend Pair** command is selected, the Suspend Pair window is displayed. Use the Suspend Pair window to select the Suspend Pair options for the pair(s). You can split a TC390 pair only after the initial copy operation is complete. For more information on split TC390 pairs, see "[Suspended Pairs](#)" on page 47.

Suspend Pair

Volume : 01:0A

SSB [F/M=FB] : Disable

Suspend Kind : R-VOL

Asynchronous Parameters

Suspend Range : Volume

Pending Update : Drain

Set Cancel

Java Applet Window

Figure 65 Suspend Pair window (Asynchronous)



NOTE: When you set the several pairs at once and you want to keep some of the individual settings, leave the parameter box blank. Then, only the parameters you enter are available.

Use the Suspend Pair window to select the Suspend Pair options for the pair(s):

- **Volume:** Device ID of M-VOL.



NOTE: If # is added to the end of an LDEV number, such as **00:3F#**, the LDEV is an external volume. For more information about external volumes, see "[HPAV for the XP128/XP1024/XP12000](#)" on page 351

- **SSB [F/M = FB]:** When this option is enabled (and PPRC Support = Yes), the MCU will notify all attached hosts (IEA494I message) that the pair was suspended. This option should always be enabled.



NOTE: If PPRC support = No, the x'FB' sense information will not be reported to the host, even if the **SSB (F/M = FB)** suspend option is enabled.

- **Suspend Kind:** This option specifies the suspend type of the selected pair(s). The default setting is **R-VOL**.
 - **M-VOL Failure.** This setting can be used only for TC390 Synchronous pairs. The MCU will reject all write I/O operations to the M-VOL while the pair is suspended, regardless of the fence level setting. Use this setting if you need to maintain synchronization of the TC390 pair. This setting is functionally equivalent to CSUSPEND with the optional PRIMARY parameter (without QUIESCE).
 - **R-VOL.** The M-VOL will accept all subsequent write I/O operations and the MCU will keep track of updates while the pair is suspended. Use this setting if you need to keep the M-VOL online. This setting is functionally equivalent to CSUSPEND without the optional PRIMARY parameter.
- **Asynchronous Parameters:**
 - **Suspend Range:** Use this option to select the TC390A suspend group operation. The CSUSPEND TSO command supports the TC390A suspend group operation (see ["Using PPRC Commands for TrueCopy"](#) on page 160)
 - Group.** The MCU/RCU will suspend all other TC390A pairs in the same consistency group as the specified pair(s).
 - Volume.** The MCU/RCU will suspend only the specified TC390A pair(s) (even if the error level of the pair is group).



NOTE: With the setting of Volume for Suspend Range, if there are Duplex status pairs and pairs other than Duplex status in the same consistency group, unexpected suspend may occur during the pair operations (Suspend, Delete, and Resume) under the heavy I/O load conditions. You can estimate whether the I/O load condition is heavy or not from the rate of sidefile cache (around 30%), or from the frequency of the host I/O if you cannot see the rate of sidefile cache. The pair operations should be performed under the light I/O load condition.

- **Pending Update:** This option specifies the TC390A suspend mode. The CSUSPEND TSO command supports the TC390A suspend mode option (["Using PPRC Commands for TrueCopy"](#) on page 160).
 - Drain.** The RCU will finish settling all pending recordsets for the pair as soon as the RCU accepts the suspend operation. After settling all the recordsets, if there is no recordset for a fixed period of time, the MCU will change the TC390A pair status from suspending to suspended.



NOTE: If the RCU is not able to complete these actions within the copy pending timeout setting, the RCU will discontinue the original suspend request and forcibly suspend the affected volume pairs. Thus, you can use the copy pending timeout parameter to limit the amount of time it takes to complete the suspend/drain operation.

Purge. The MCU will change the TC390A pair status from *suspending* to *suspended* as soon as the RCU accepts the suspend operation. The MCU and RCU discard any pending recordsets and mark the cylinders that contain discarded recordsets as modified in the M-VOL and R-VOL bitmap, respectively. When the pair is resumed, the M-VOL and R-VOL bitmaps will be merged at the MCU, and all cylinders marked as modified will be copied to the R-VOL.



NOTE: If the MCU does not receive acknowledgement of the suspend operation from the RCU within the copy pending timeout setting, the MCU will forcibly suspend all affected pairs and report an IEA491E host console message.

To suspend one or more TC390 volume pairs:

1. Connect to the MCU (or RCU) of the volume pair(s) to be suspended. You do not need to vary the M-VOL(s) offline. If you want to use the R-VOL write enable option, you must connect to the MCU and select the M-VOL of the pair.
2. From the CU Number tree on the TrueCopy main window, select the number of the correct CU image.
3. From the Volume list on the TrueCopy main window, select the TC390 volume pair(s) that you want to suspend. Select either TC390 Synchronous or TC390A pairs, but not both. The pair status must be **Duplex**.
4. Right-click to display the pop-up menu and click **Suspend Pair**. The Suspend Pair window is displayed.
5. From the Suspend Pair window, select the options for the pair(s), and then click **Set** to close the Suspend Pair window and set the parameters. The list changes to the Pair Settings Parameter list (Suspend Pair). You can modify the options as needed (see "[Modifying Parameters and Omitting Selected Volumes](#)" on page 122). Verify that the Suspend Pair options for each pair are correct. The suspend kind option (**R-VOL** or **M-VOL failure**) and fence level pair option determine whether the M-VOL will accept write I/O operations after the pair is split.



CAUTION: If you need to split a pair and the M-VOL is required for system operation, do not use the **M-VOL Failure** suspend kind option. Make sure to use the **R-VOL** suspend kind option so that the M-VOL continues accepting I/Os.

6. If you want to execute the Suspend Pair requests quickly, select the **Use Time-Saving Mode** check box above the Pair Settings Parameter list (Suspend Pair).
7. Click **Apply** on the TrueCopy main window to split the specified pair(s). For the TC390 Synchronous pairs, the MCU will complete all M-VOL write operations in progress and the associated update copy operations at the R-VOL before splitting the pair so that the pair is synchronized at the time of Suspend Pair.
8. From the TrueCopy main window, verify that the TC390 pair(s) is/are displayed correctly (**Suspended** status) in the Volume list. The **Resume Pair** command (see "[Resuming TrueCopy Volume Pairs \(Resume Pair\)](#)" on page 134) resumes suspended TC390 volume pair(s).



CAUTION: If a timeout error occurs after clicking the **Use Time-Saving Mode** option, confirm on the TrueCopy main window for which volumes the Suspend Pair operation could not be performed. Deselect the **Use Time-Saving Mode** option for the failed volume and retry the Suspend Pair operation.

Resuming TrueCopy Volume Pairs (Resume Pair)

While a TC390 pair is suspended, the MCU does not perform any update copy operations. For a suspended TC390 Synchronous pair, the MCU may or may not continue accepting write I/Os for the M-VOL depending on the M-VOL fence level and suspend option (if user-requested). If the MCU accepts write I/Os for a suspended M-VOL, the MCU keeps track of the M-VOL cylinders that are updated while the pair is suspended, and then copies the VOLSER and out-of-sync cylinders to the R-VOL when the pair is resumed. For a suspended TC390A pair, the MCU and RCU keep track of any recordsets that were discarded during suspension, and the MCU continues accepting write I/Os for the M-VOL. When a

TC390A pair is resumed, the MCU merges the M-VOL and R-VOL cylinder bitmaps and then copies the VOLSER and out-of-sync cylinders to the R-VOL to resynchronize the pair.

The **Resume Pair** command resumes split/suspended TC390 pairs. When the **Resume Pair** command is selected, the Resume Pair window is displayed. Use the Resume Pair window to change the pair options and select the resume range option (asynchronous) for the selected pair(s).

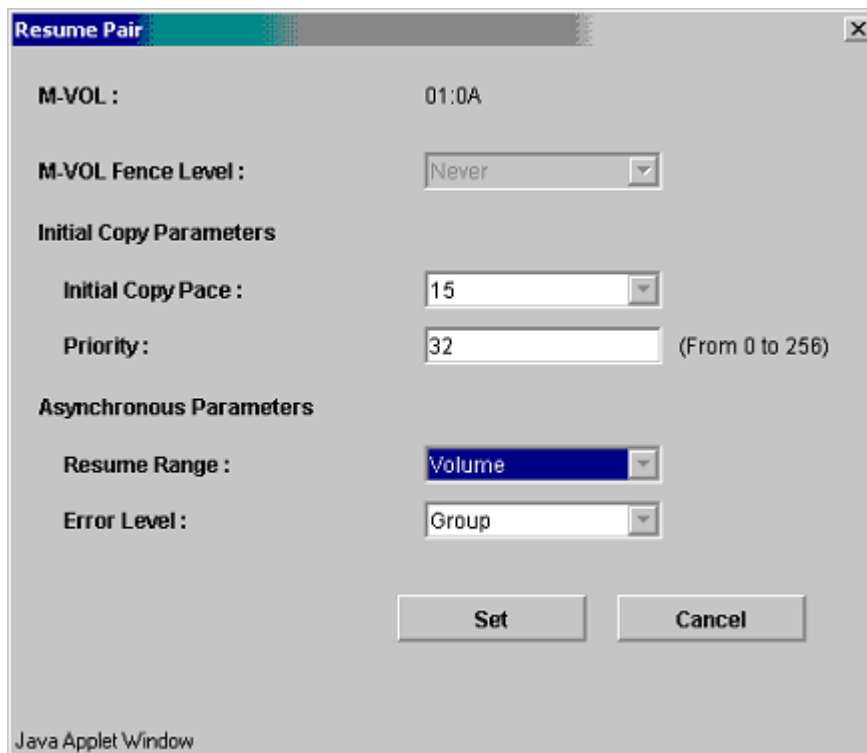


Figure 66 Resume Pair window



NOTE: When you set the several pairs at once and you want to keep some of the individual settings, leave the parameter box blank. Then, only the parameters you enter are available.

- **M-VOL:** Device ID of the M-VOL.



NOTE: If # is added to the end of an LDEV number, such as **00:3F#**, the LDEV is an external volume. For more information about external volumes, see "[HPAV for the XP128/XP1024/XP12000](#)" on page 351.

- **M-VOL Fence Level:** Select the fence level. **Never:** Never fence the operation. **Data:** Fence when the MCU cannot successfully execute an update copy operation for any reason. **Status:** Fences only if the MCU is not able to change the R-VOL status to the same status as the M-VOL. For synchronous mode only. When the asynchronous pair(s) is being created, **Never** is set automatically.
- **Initial Copy Parameters:**
 - **Initial Copy Pace (3 or 15):** Select the number of the tracks 3 or 15 for resume copy. The default setting is 15.
 - **Priority (From 0 to 256):** Set the priority (0-256) for the resume operation, which determines the order in which the resume operations will be performed.

- **Asynchronous Parameters:**

- **Resume Range:** When **Group** is selected, resume all split or suspended TC390A pairs in the same group as the selected pair. When **Volume** is selected, resume only the selected TC390A pair(s).
- **Error Level:** The **Error Level** option specifies the error level for the TC390A pair(s): Group or Volume. This option is available only when **Volume** is selected for the Resume Range.



NOTE: With the setting of Volume for Resume Range, if there are Duplex status pairs and pairs other than Duplex status in the same consistency group, unexpected suspend may occur during the pair operations (Suspend, Delete, and Resume) under the heavy I/O load conditions. You can estimate whether the I/O load condition is heavy or not from the rate of sidefile cache (around 30%), or from the frequency of the host I/O if you cannot see the rate of sidefile cache. The pair operations should be performed under the light I/O load condition.

For more information about the option parameters, see ["Creating TrueCopy Volume Pairs \(Add Pair\)"](#) on page 126.



NOTE: The CESTPAIR (MODE=RESYNC) command can be used to resume suspended TC390 Synchronous and TC390A pairs (see ["Using PPRC Commands for TrueCopy"](#) on page 160).

If an MCU/RCU is powered off and its backup batteries are fully discharged while TC390 pairs are suspended, the M-VOL/R-VOL cylinder bitmaps will not be retained. In this unlikely case, the MCU/RCU will mark all cylinders of all split or suspended TC390 volumes as modified so that the MCU will perform the equivalent of an entire initial copy operation when the pairs are resumed.

To resume one or more split or suspended TC390 volume pairs:

1. If any pair was suspended due to an error condition (use the Pair Status window to view the suspend type), verify that the error condition has been removed (see ["General TrueCopy Troubleshooting"](#) on page 153 for troubleshooting instructions). The MCU will not resume the pair(s) until the error condition has been removed.
2. Connect to the MCU of the pair(s) to be resumed and start the TC390 software.
3. From the CU Number tree on the TrueCopy main window, select the number of the correct CU image.
4. If you are resuming split or suspended Volumes, select the pair(s) on the Volume list on the TrueCopy main window. Select Suspended pairs. Select either Sync or Async pairs (not both). If you plan to use the **Resume Range** option, select only one TC390A pair in the group.
5. Right-click to display the pop-up menu and click **Resume Pair**. The Resume Pair window is displayed.
6. From the Resume Pair window, select the appropriate pair options, and click **Set** to close the Resume Pair window and set the parameters. The list changes to the Pair Settings Parameter list (Resume Pair). Verify that all resume options and pair options for each pair are correct.



NOTE: The options can be modified and/or canceled after you have set them. See ["Modifying Parameters and Omitting Selected Volumes"](#) on page 122.

If you want to resume all split/suspended TC390A pairs in a consistency group, verify that the **Resume Range** option on the Resume Pair window is set to **Group**.

7. If you want to execute the Resume Pair requests quickly, select the **Use Time-Saving Mode** check box above the Pair Settings Parameter list (Resume Pair).
8. Click **Apply** on the TrueCopy main window to resume the specified pair(s).

9. From the TrueCopy main window, verify that the TC390 pair(s) is/are displayed correctly (**Pending duplex** or **Duplex** status) in the Volume list.



CAUTION: If a timeout error occurs after clicking the **Use Time-Saving Mode** option, confirm on the TrueCopy main window for which volumes the Resume Pair operation could not be performed. Deselect the **Use Time-Saving Mode** option for the failed volumes and retry the Resume Pair operation.

Deleting TrueCopy Volume Pairs (Delete Pair)

A TC390 pair should be deleted from the MCU only when it is no longer necessary to maintain a remote copy of the M-VOL. When a TC390 volume pair is deleted from the MCU, the MCU stops all TC390 copy operations for that pair and changes the pair status of the M-VOL and R-VOL to *simplex*. After a pair is deleted, the MCU continues to accept all subsequent write I/O operations to the M-VOL and will not keep track of the M-VOL updates.

A TC390 pair should be deleted from the RCU only if you need to access the R-VOL, such as to perform ICKDSF on the R-VOL (see ["ICKDSF Considerations for TrueCopy Volumes"](#) on page 142) or for disaster recovery (see ["TrueCopy Disaster Recovery Operations"](#) on page 146). When a TC390 volume pair is deleted from the RCU, the RCU changes the R-VOL pair status to *simplex*, but does not change the pair status of the corresponding M-VOL. When the MCU performs the next TC390 operation, the MCU detects that the R-VOL status changed and changes the status of the M-VOL to *suspended-delete pair to RCU*.

When you delete a pair from the RCU to access the R-VOL, remember that the R-VOL and M-VOL have the same VOLSER and take appropriate precautions to prevent a system problem due to duplicate VOLSERs. To restart a pair that was deleted from the RCU, you must first delete the pair from the MCU, and then add the pair from the MCU using the appropriate initial copy option (**Entire** or **No Copy**) to restart the pair.

You can delete all TC390 Synchronous pairs between an MCU and RCU (same CU image). You can also delete all TC390A pairs in a consistency group by connecting to the MCU. The TC390A pair status will change to *deleting* when the delete operation is accepted by the MCU and RCU, and then to *simplex* after the internal delete pair process is complete. In addition, you can delete TC390A pairs according to their consistency status (for example, for disaster recovery) by connecting to the RCU (the RCU maintains the consistency status).



NOTE: The CDELPAR TSO command can be used to delete TC390 pairs and TC390A groups of pairs from the MCU (see ["Using PPRC Commands for TrueCopy"](#) on page 160).



CAUTION: For information about duplicate VOLSERs, see the caution in ["Duplicate VOLSER"](#) on page 55.

As a general rule, when you want to delete a TC390A pair from the MCU, it is strongly recommended that you perform the Delete Pair operation after the update copy operation is completed. If you demand the Delete Pair operation while the update copy process is still in progress, it will take a long time to complete the Delete Pair operation. However, when you urgently need to delete a TC390A pair, you can perform the Delete Pair operation from the RCU. In this case, you will find the suspended status at the MCU after the Delete Pair operation from the RCU.

The **Delete Pair** command deletes one or more TC390 pairs. When the **Delete Pair** command is selected, the Delete Pair window is displayed. Use the Delete Pair window to change the Delete Pair options (by force and TC390A delete range) for the pair(s) selected on the Volume list of the Pair Operations window.

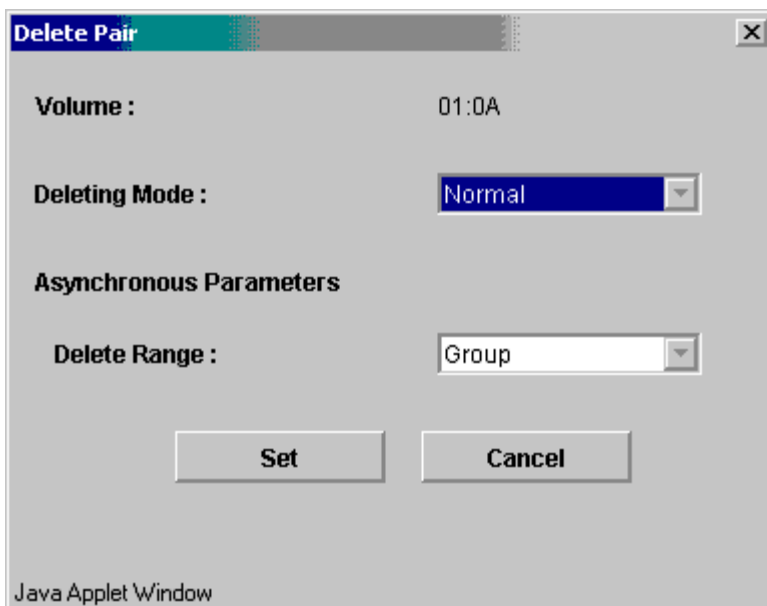


Figure 67 Delete Pair window (Asynchronous)



NOTE: When you set the several pairs at once and you want to keep some of the individual settings, leave the parameter box blank. Then, only the parameters you enter are available.

- **Volume:** Device ID of the MCU.



NOTE: If # is added to the end of an LDEV number, such as **00:3F#**, the LDEV is an external volume. For more information about external volumes, see "[HPAV for the XP128/XP1024/XP12000](#)" on page 351.

- **Deleting Mode:** Select the restriction on deleting a TC390 volume pair.
 - **Normal:** Normal deleting operation is performed.
 - **All:** Deletes all TC390 Synchronous pairs with the same MCU and RCU (same CU image) as the selected pair. This option can be selected from the MCU or RCU, and the **Force** option must also be selected. This option deletes the pairs more quickly than if you select all pairs on the TrueCopy main window and delete them.
 - **Force:** Overrides the restrictions on deleting a TC390 volume pair. If this option is selected, the pair(s) will be deleted even if the MCU is unable to communicate with the RCU. This option may be used to free a host waiting for device-end from an MCU that cannot communicate with its RCU, thus allowing host operations to continue. If this option is not selected, the pair(s) will only be deleted if the MCU is able to change the pair status of the M-VOL and R-VOL to *simplex*.

When the status of the pair that is deleted is Simplex or Deleting, the default setting is **Force** (cannot be changed). When the status of the pair is not Simplex or Deleting, the default setting is **Normal**.

- **Asynchronous Parameters, Delete Range:** Select the TC390A delete range option. This option simplifies disaster recovery operations for TC390A consistency groups at the RCU (secondary or remote disk array).

The TC390 delete range options are:

- **Group** (MCU or RCU). When **Group** is selected, the MCU/RCU will delete all TC390A pairs in the same consistency group as the specified pair regardless of pair status and consistency status.



CAUTION: Do not use this option when deleting pairs at the RCU during disaster recovery. This option is available only when one pair is selected.

- **C/T** (RCU only). When **C/T** is selected, the RCU will delete all TC390A pairs that have the same consistency time.
- **Volume** (MCU or RCU). When **Volume** is selected, the MCU/RCU will delete only the specified TC390A pair(s). This option can be used to remove individual volumes from consistency groups.



NOTE: With the setting of Volume for Delete Range, if there are Duplex status pairs and pairs other than Duplex status in the same consistency group, unexpected suspend may occur during the pair operations (Suspend, Delete, and Resume) under the heavy I/O load conditions. You can estimate whether the I/O load condition is heavy or not from the rate of sidefile cache (around 30%), or from the frequency of the host I/O if you cannot see the rate of sidefile cache. The pair operations should be performed under the light I/O load condition.

The default settings are as follows:

- More than one pairs are selected: Volume.
- One pair is selected and the pair is M-VOL: Group.
- One pair is selected and the pair is R-VOL: C/T.



NOTE: When an asynchronous pair is forcibly deleted, the TC390 delete range option must be Group. Therefore, more than one pair cannot be forcibly deleted.

To delete one or more TC390 volume pairs:

1. If you need to delete the volume pair(s) from the RCU to access the R-VOL(s) (for example, to perform ICKDSF), connect to the MCU(s) and suspend the volume pair(s) first (see ["Suspending TrueCopy Pairs \(Suspend Pair\)"](#) on page 132 for instructions).
2. Connect to the MCU or RCU of the pair(s) to be deleted and start the TC390 software. If you plan to use the TC390A C/T delete range option, you must connect to the RCU.
3. From the CU Number tree on the TrueCopy main window, select the CU number of the correct CU image.
4. From the Volume list on the TrueCopy main window, select the TC390 volume pair(s) that you want to delete. Select either TC390 Sync or Async pairs, but not both. If you plan to use the TC390A **C/T** or **Group** delete range option, select only one TC390A pair in the group.
5. Right-click to display the pop-up menu and click **Delete Pair**. The Delete Pair window is displayed.
6. From the Delete Pair window, select the Delete Pair options for the selected pair(s), and click **Set** to close the Delete Pair window and set the parameters. The list changes to the Pair Settings Parameter list (Delete Pair). Repeat this step as needed to set Delete Pair options for the pair(s).



NOTE: The options can be modified and/or canceled after you have set them. See "[Modifying Parameters and Omitting Selected Volumes](#)" on page 122.

7. If you want to execute the Delete Pair requests quickly, select the **Use Time-Saving Mode** check box above the Pair Settings Parameter list (Delete Pair).
8. Click **Apply** on the TrueCopy main window to delete the specified pair(s).
9. When deleting TC390A pairs, verify that the Delete Pair request was completed successfully by checking the detailed TC390 pair status information on the Pair Status window (should be **Simplex**, not **Deleting** or **Suspended**).

When deleting TC390 Sync pairs, verify that the Delete Pair request was completed successfully by checking the pair status on the **Pair Operations** tab (**Simplex** status).

10. To restart a pair that was deleted from the RCU, first delete the pair from the MCU, and then use the **Add Pair** command with the appropriate TC390 initial copy option (**Entire** or **No Copy**) to restart the pair.



CAUTION: If a timeout error occurs after clicking the **Use Time-Saving Mode** option, confirm on the TrueCopy main window for which volumes the Delete Pair operation could not be performed. Deselect the **Use Time-Saving Mode** option for the failed volumes and retry the Delete Pair operation.

Changing the Pair Options (Change Pair Option)

The **Change Pair Option** command changes the pair options, **Fence level**, **CFW Data**, and **Error level** (asynchronous pairs only). When the **Change Pair Option** command is selected, the Change Pair Option window is displayed. From the Change Pair Option window, the pair options can be changed.

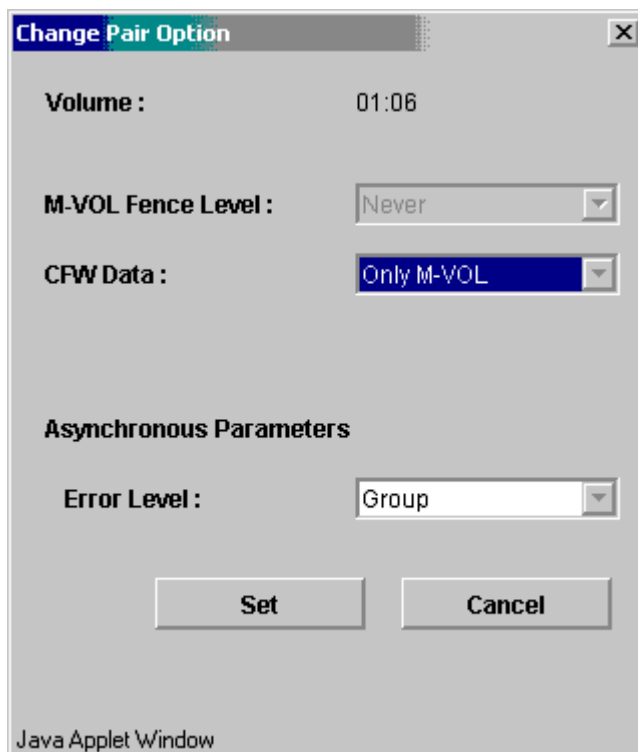


Figure 68 Change Pair Option window (Asynchronous)



NOTE: When you set the several pairs at once and you want to keep some of the individual settings, leave the parameter box blank. Then, only the parameters you enter are available.

- **Volume:** The CU number and the device ID.



NOTE: If # is added to the end of a device ID, such as 00:3F#, the LDEV is an external volume. For more information about external volumes, see ["HPAV for the XP128/XP1024/XP12000"](#) on page 351.

- **M-VOL Fence Level (Synchronous only):** Select the fence level for the new pair(s). The fence level determines the conditions under which the MCU rejects write operations to the M-VOL. **Never** is automatically set for an asynchronous pair. See ["Performing TrueCopy Pair Operations"](#) on page 120 for more information about this pair option.
 - **Never:** M-VOL is never fenced.
 - **Data:** M-VOL is fenced when the MCU cannot successfully execute an update copy operation for any reason.
 - **Status:** M-VOL is fenced only if the MCU cannot change the R-VOL status to suspended when an update copy operation fails.
- **CFW Data:** Specifies whether the CFW data is copied to the R-VOL. For TCPD-MF, only Copy to R-VOL is available.
- **Asynchronous Parameters (Async only):**
 - **Error Level:** Error level for the new pair(s): **Group**, or **Volume**.



NOTE: To set the parameters on multiple volumes at once without changing individual parameters per volume, make the box for the parameters you do not want to change blank. Only parameters you input are changed.

- **Cancel:** Cancels settings you made and closes the Change Pair Option panel.
- **Set:** Sets parameters and closes the Change Pair Option panel.

To change the pair options for one or more TC390 volume pairs:

1. Connect to the MCU of the pair(s) to be changed the options and start the TC390 software.
2. From the CU Number tree on the TrueCopy main window, select the CU number of the correct CU image.
3. From the Volume list on the TrueCopy main window, select the TC390 volume pair(s) that you want to modify the options. Select either TC390 Sync or Async pairs, but not both.
4. Right-click to display the pop-up menu and click **Change Pair Option**. The Change Pair Option window is displayed.
5. From the Change Pair Option window, select the pair options for the selected pair(s), and click **Set** to close the Change Pair Option window and set the parameters. The list changes to the Pair Settings Parameter list (Change Pair Option). Repeat this step as needed to change the pair options for the pair(s).



NOTE: The options can be modified and/or canceled after you have set them. See ["Modifying Parameters and Omitting Selected Volumes"](#) on page 122.

6. If you want to execute the pair option change requests quickly, select the **Use Time-Saving Model** check box above the Pair Settings Parameter list (Change Pair Option).
7. Click **Apply** on the TrueCopy main window to change the options for the specified pair(s).
8. From the TrueCopy main window, verify that the pair option change was completed successfully.

ICKDSF Considerations for TrueCopy Volumes

The XP128/XP1024/XP12000 supports the use of the ICKDSF utility program. ICKDSF performs functions for the installation, use, and maintenance of DASD as well as service functions, error detection, and media maintenance.

ICKDSF on a TrueCopy M-VOL

ICKDSF activities involve write I/O operations with device support authorization instead of normal authorization. Because the MCU does not duplicate write I/O operations with device support authorization at the R-VOL of a TC390 volume pair, you must suspend a TC390 pair before running ICKDSF on a TC390 M-VOL.

To perform ICKDSF on a TC390 M-VOL:

1. Connect to the MCU of the volume pair, and then start the TC390 software.
2. Suspend the volume pair, if not already suspended, using the **R-VOL** suspend option and the TC390A **Volume** and **Purge** suspend options (see ["Suspending TrueCopy Pairs \(Suspend Pair\)"](#) on page 132). You can also use the CSUSPEND TSO command to suspend the pair.
3. After the M-VOL status changes to *suspended/R-VOL by operator*, run ICKDSF to repair the M-VOL.
4. When volume repairs are complete, resume the TC390 pair. When resuming a suspended TC390A pair, make sure to use the appropriate **Resume** level pair option (see ["Resuming TrueCopy Volume Pairs \(Resume Pair\)"](#) on page 134). You can also use the CESTPAIR (MODE=RESYNC) command to resume the pair.

ICKDSF on a TrueCopy R-VOL

If you need to run ICKDSF on a TC390 R-VOL, you must change the status of the R-VOL to *simplex* to allow write access to the R-VOL. The TC390 pair must then be restarted using the appropriate initial copy options.

To perform ICKDSF on a TC390 R-VOL:

1. For TC390 Synchronous pairs, you can stop write I/Os to the M-VOL while the R-VOL is being repaired. To do this, suspend the pair from the MCU using the **M-VOL Failure** suspend option (see ["Suspending TrueCopy Pairs \(Suspend Pair\)"](#) on page 132) (or use CSUSPEND to suspend the pair).
2. Connect to the disk array containing the R-VOL, and then start the TC390 software.
3. On the TrueCopy main window, locate and select the R-VOL to be repaired, and then delete the pair. For a TC390A R-VOL, make sure to use the **Volume** delete option (see ["Deleting TrueCopy Volume Pairs \(Delete Pair\)"](#) on page 137). You can also use CRECOVER to delete the pair at the RCU.
4. If necessary, change the R-VOL VOLSER to avoid problems due to duplicate VOLSERs.
5. Vary the R-VOL online and run ICKDSF to repair the R-VOL. When the volume repairs are complete, vary the R-VOL offline.
6. Connect to the MCU, locate and select the M-VOL, note the group number, and delete the pair. For a TC390A M-VOL, make sure to use the **Volume** delete option.

7. Restart the pair using the Add Pair window (or CESTPAIR). Use the **Entire** initial copy option to resynchronize the M-VOL and R-VOL.



NOTE: If you are absolutely sure that the M-VOL and R-VOL are still identical, you can restart the pair using the **No Copy** option.

Using TrueCopy for Data Migration and Duplication

Data Migration Using TrueCopy Synchronous

TC390 Synchronous can be used for device or workload migration with minimal impact to host applications. You may need to migrate data from one volume to another for any of the following reasons:

- To load data onto new or scratch volumes, such as for a new or upgraded disk arrays.
- To temporarily move data off a volume to accommodate other activities, such as repairing.
- To relocate volumes to balance workloads and distribute I/O activity evenly within and across disk arrays for the purpose of improving disk array and system performance.



NOTE: TC390 operations within one XP128/XP1024/XP12000 can be performed only if the SI390 option is not active on the disk array.

The TC390 initial copy operation copies the entire contents of the M-VOL to the R-VOL. The data migration is complete when the initial copy operation completes and the pair status changes from *pending duplex* to *duplex*. The P/DAS host software function is used with TC390 Synchronous to complete the data migration nondisruptively.



NOTE: If you are migrating data between disk arrays using P/DAS, both disk arrays must be the same type (XP128/XP1024/XP12000 or other XP disk arrays). If you need to migrate data from other vendors' storage disk arrays onto the XP128/XP1024/XP12000, contact your HP account support representative.

To use TC390 Synchronous to migrate data from one volume to another:

1. Vary the R-VOL(s) offline from all attached hosts. The R-VOLs are the target volumes onto which you are migrating the data. The M-VOLs (source volumes) can remain online.
2. Connect to the disk array containing the volume(s) to be migrated, and then start the TC390 software. If not already done, install the remote copy connections and configure the ports (RCPs for serial, initiator ports for fibre) (if migrating between disk arrays), and then add the RCUs.
3. On the TrueCopy main window, select the correct CU image and the appropriate volume(s), and then start the TC390 Synchronous pair(s) using the Add Pair window (see "[Creating TrueCopy Volume Pairs \(Add Pair\)](#)" on page 126).
4. Monitor the progress of the initial copy operation(s) and the status of the pair(s) on the Pair Status window (see "[Viewing the Status of TrueCopy Volume Pairs \(Pair Status\)](#)" on page 123). Refresh the window as needed. When the status has changed from *pending duplex* to *duplex*, the M-VOL and R-VOL are identical and synchronized.
5. Use the IBM P/DAS host software function (see "[P/DAS Support](#)" on page 52) to redirect all application I/Os to the R-VOL(s) nondisruptively. If the host system does not support P/DAS, use the following procedure to stop using the M-VOL(s) and switch to the R-VOL(s):
 - a. Disable all applications using the M-VOL(s).

- b. When all update activity to the M-VOL(s) has stopped, connect to the MCU, select the correct CU image, and delete the TC390 volume pair(s) (see ["Deleting TrueCopy Volume Pairs \(Delete Pair\)"](#) on page 137).

If the M-VOL(s) and R-VOL(s) are attached to the same host, vary the M-VOL(s) offline first, and then vary the R-VOL(s) online. The M-VOL(s) and R-VOL(s) have the same VOLSERs and cannot be online to the same host(s) at the same time.
- c. If an R-VOL contains more cylinders than its M-VOL, update the R-VOL volume table of contents (VTOC) using ICKDSF/REFORMAT.
- d. If you want to keep the volumes synchronized, establish the same TC390 pair(s) in the reverse direction using the **No Copy** initial copy option (see ["Creating TrueCopy Volume Pairs \(Add Pair\)"](#) on page 126). If the original M-VOL(s) will be temporarily unavailable for update copy operations, you can suspend the new pair(s) so that the new MCU keeps track of changes.
- e. Start the applications with the R-VOL(s). When the original M-VOL(s) are available, you can resume the pair(s) using the Resume Pair window (see ["Resuming TrueCopy Volume Pairs \(Resume Pair\)"](#) on page 134).

Point-in-Time (PiT) Data Duplication Using TrueCopy Asynchronous

You can use TC390 to make Point-in-Time (PiT) duplicates of groups of volumes. The TC390A **Group** and **Drain** suspend options can be used together to create a PiT copy, relative to an application, of an entire TC390A consistency group of volumes.

To produce a PiT duplicate of an existing TC390A consistency group:

1. Disable the applications accessing the TC390A M-VOLs to stop all update activity to all M-VOLs in the group.
2. After all M-VOL updates have completed, suspend the TC390A group using the **Group** and **Drain** suspend options. If you are suspending the group at the main site, issue the suspend/group command to one M-VOL in the MCU. If you are suspending the group at the remote site, issue the suspend/group command to one R-VOL in the RCU.



NOTE: The copy pending timeout setting for the group determines the maximum amount of time that the suspend/drain operation can take.

3. When the status for all TC390A pairs in the group has changed to *suspended*, the duplicate set of volumes is complete. If needed, you can restart the application at the main site.

Powering Off/On TrueCopy Components

The user is responsible for controlling power-off activities for disk arrays involved in TC390 operations. If you need to power off the XP128/XP1024/XP12000, call your HP representative or HP technical support for assistance. This section provides instructions for performing planned outages of TC390 components.

If power is removed from an MCU while TC390 operations are in progress, the TC390 pairs are not affected, but the update sequence consistency of the TC390A groups at the RCU may be affected. For more information, see ["Planned Outage of the MCU"](#) on page 145. When power is restored to an MCU, the MCU communicates with its RCU(s) to confirm the pair status of the R-VOLs. Verify that TC390 communications are fully restored (all RCU paths have normal status) before beginning I/O operations to the M-VOLs. If the MCU accepts a write I/O operation for an M-VOL before this confirmation is complete, the MCU will suspend the pair and change the status of the M-VOL to *suspended-by RCU* (the MCU will not be able to change the pair status of the R-VOL).

If power is removed from an RCU or remote copy connection while TC390 operations are in progress, the MCU(s) will detect the communication failure, suspend all affected pairs, and generate SIMs and console messages reporting the failures. The MCU will change the status of the M-VOLs to *suspended-by RCU*, but will not be able to change the status of the R-VOLs.



NOTE: If an MCU/RCU is powered off and its backup batteries are fully discharged while TC390 pairs are suspended, the M-VOL/R-VOL cylinder maps will not be retained. In this unlikely case, the MCU/RCU will mark all cylinders of all suspended TC390 volumes as modified so that the MCU will perform the equivalent of an entire initial copy operation when the pairs are resumed. (The R-VOL cylinder map is used only for TC390A operations.)

Planned Outage of the MCU

A planned MCU outage does not affect TC390 Synchronous pairs. For TC390A operations, the MCU must communicate with the RCU even when there are no M-VOL update I/Os from the primary system. During the power-off sequence, the MCU will automatically suspend all TC390A pairs in the *duplex* and *duplex pending* state (suspend type = MCU P/S-OFF). During power-on-reset sequence, the MCU will automatically resume these suspended pairs (pairs with other suspend types are not automatically resumed).

If a TC390A group contains M-VOLs in the MCU being powered off and in other MCU(s) that is/are not being powered off, the pairs behind the other MCU(s) will not be suspended and will continue to be updated.

To maintain a fully consistent group at the RCU during the planned MCU outage:

1. Disable the applications using all M-VOLs in the consistency group.
2. Suspend the group at the RCU using the **Group** suspend option. You can use the **Purge** or **Drain** suspend option because the M-VOL updates have stopped.
3. Perform the planned outage of the TC390 MCU.
4. When the MCU is fully powered on and ready to resume operations, resume the TC390A pairs at all MCUs that were powered off (use the resume group option).

Planned Outage of the RCU or Remote Copy Connection

You must suspend all affected TC390 pairs prior to a planned outage of an RCU or of a remote copy connection component (for example, ESCON director, channel extender, switch, or extender). If you do not suspend the pairs first, the MCU(s) will detect the communication failure, suspend all affected pairs, and generate SIMs and console messages reporting the failures.

To perform a planned outage of a TC390 RCU or remote copy connection component:

1. Identify all TC390 M-VOLs that will be affected by the equipment outage. You need to know the MCU, CU image, and LDEV ID for each of these M-VOLs.
 - For RCU power-off, identify all M-VOLs that are paired with R-VOLs in the RCU to be powered off.
 - For remote copy connection outage, identify all M-VOLs in all MCUs that use the path/component to be powered off.
2. Connect to each MCU that contains affected M-VOLs and suspend all affected TC390 pairs. Make sure to confirm the pair status changes (TC390 Pair Status window or CQUERY TSO command).
3. Perform the planned outage of the RCU or remote copy connection.
4. When the RCU is fully powered on and ready to resume operations, resume all TC390 pairs at each MCU. Make sure to confirm the pair status changes.

Planned Outage of the MCU and RCU

When you plan an outage of TC390 MCUs and RCUs at the same time, the MCUs must be powered off before the RCUs and powered on after the RCUs.

To perform a planned outage of a TC390 MCU and RCU:

1. If RCU power-on will be difficult to control (for example, Power-Control-Interface setting), consider increasing or disabling the **RCU ready timeout** group option (see ["Group Options" on page 44](#)) for each TC390A group with R-VOLs in the RCU(s) to be powered off.
2. Perform the planned outage of the MCU(s) as described in ["Planned Outage of the MCU" on page 145](#). Do not power-on the MCU(s) yet.
3. If an RCU to be powered off is connected to an MCU that is not powered off, make sure to suspend those TC390 pairs before powering off the RCU as described in ["Planned Outage of the RCU or Remote Copy Connection" on page 145](#).
4. Perform the planned outage of the RCU(s).
5. Power on the RCU(s). Verify that they are fully operational and ready to resume operations before powering on the MCUs.
6. Power on the MCU(s) and verify that they are ready to resume operations. If you suspended any pairs in [step 3](#), you can also resume those pairs now.

TrueCopy Disaster Recovery Operations

Preparing for Disaster Recovery

The type of disaster and the status of the TC390 volume pairs will determine the best approach for disaster recovery. For example, if all TC390 volume pairs are in the *duplex* state when a total system failure occurs at a single point in time, the R-VOLs are current and recovery is straightforward. Unfortunately, some disasters are not so "orderly" and involve intermittent or gradual failures occurring over a longer period of time. The user should anticipate and plan for all types of failures and disasters.

The major steps in preparing for disaster recovery are:

1. Identify the volumes and volume groups that contain important files and data for disaster recovery, such as DB2 log files, master catalog, key user catalogs, and system control data sets. In addition to supporting TC390 remote copy operations as well as PPRC commands, the XP128/XP1024/XP12000 provides battery-backed nonvolatile duplexed cache, full hardware redundancy, dynamic sparing, and an advanced RAID-5 implementation to ensure full data integrity in the event of a sudden power outage or other failure.
2. Install the Command View and TC390 hardware and software, and establish TC390 operations for the volumes and groups identified in [step 1](#). Make sure to select the correct CU images to access the appropriate volumes.
3. Use the appropriate combination of TC390 options for disaster recovery:
 - RCU options: **Incident of RCU**, **PPRC Support**, **Service SIM of Remote Copy**, and **FREEZE Option** (see ["Registering an RCU \(Add RCU\)" on page 93](#)).
 - TC390A **offloading timer** asynchronous option (see ["Asynchronous Copy Option" on page 112](#)) and TC390A **copy pending timeout** group option (see ["Adding Consistency Groups \(Add CT Group\)" on page 109](#)). The **copy pending timeout** group option can be used to limit the time duration during which updates may be lost.
 - TC390A **Error Level** pair option and **M-VOL Fence Level** pair option for TC390 Synchronous pairs (see ["Creating TrueCopy Volume Pairs \(Add Pair\)" on page 126](#)).
4. Establish file and database recovery procedures. These procedures should already be established for recovering volumes that are inaccessible due to control unit failure.
5. Install and configure error reporting communications (ERC) between the main and remote sites. ERC is essential if you use the M-VOL fence level setting of **R-VOL Status** or **Never** for any TC390 volume pairs.

6. Configure the primary host system to use the IEA494I message as a trigger for automation rather than the IEA491E message. The IEA491E message is reported to only one host, whereas the IEA494I message is reported to all attached MVS hosts each time the M-VOL pair status changes. For more information on the IEA494I and IEA491E system console messages, see ["IEA494I and IEA491E Console Messages"](#) on page 180.

Considering the M-VOL Fence Level Setting

The M-VOL fence level setting (see ["Creating TrueCopy Volume Pairs \(Add Pair\)"](#) on page 126) for each TC390 Synchronous volume pair determines whether the M-VOL will be fenced when TC390 remote copy operations fail. The following table summarizes the effect of the fence level setting on a TC390 Synchronous M-VOL.



NOTE: The M-VOL fence level setting does not apply to TC390A pairs. The TC390A M-VOL is never fenced due to suspension of the pair.

Table 20 Fence level setting on a TrueCopy M-VOL

Type of Failure		Fence Level Setting		
		R-VOL Data (CRIT=Y(ALL))	R-VOL Status (CRIT=Y(PATHS))	Never (CRIT=NO)
The update copy operation failed and the MCU was able to change the status of the R-VOL to <i>suspended</i> .	Write I/O operations to the M-VOL will be:	REJECTED	Accepted	Accepted
The update copy operation failed and the MCU was NOT able to change the status of the R-VOL to <i>suspended</i> .	Write I/O operations to the M-VOL will be:	REJECTED	REJECTED	Accepted

R-VOL Data (CRIT=Y(ALL)). When this fence level setting is selected, the M-VOL will be fenced if an update copy operation fails. This M-VOL fence level setting ensures that the R-VOL remains identical to the M-VOL after the TC390 volume pair is synchronized, but makes the M-VOL inaccessible to applications for updates whenever TC390 remote copy operations fail. This setting should be considered for the most critical volumes for disaster recovery. This setting will reduce the amount of time required to analyze the currency of the R-VOL during disaster recovery efforts. This setting is also designed for applications that can continue to operate with another device pair (for example, IMS logger dual write log files).

R-VOL Status (CRIT=Y(PATHS)). When this fence level is selected, the M-VOL is fenced only if the MCU is not able to change the R-VOL pair status to suspended. If the MCU successfully changes the R-VOL pair status to suspended, subsequent write I/O operations to the M-VOL will be accepted and the MCU will keep track of updates to the M-VOL. This allows the volume pair to be resumed quickly using the resync (out-of-sync-cylinders) copy operation (MODE=RESYNC). This setting will also reduce the amount of time required to analyze the R-VOL currency during disaster recovery.

Never (CRIT=NO). When this fence level is selected, the M-VOL is never fenced when the pair is suspended. This M-VOL fence level setting ensures that the M-VOL remains available to applications for updates, even if all TC390 copy operations have failed. The R-VOL may no longer be in sync with the M-VOL, but the MCU will keep track of updates to the M-VOL while the pair is suspended. ERC is essential if this fence level setting is used. For disaster recovery, the currency of the R-VOL is determined by using the sense information transferred through ERC or by comparing the R-VOL contents with other files confirmed to be current.



NOTE: To exchange CRIT=Y(ALL) and CRIT=Y(PATHS), XP128/XP1024/XP12000 mode 36 can be used. For more information on the XP128/XP1024/XP12000 modes, see [Table 3](#) on page 28.

Transferring Sense Information Between Sites

When the MCU (or RCU for TC390A) suspends a TC390 pair due to an error condition, the MCU/RCU sends sense information with unit check status to the appropriate host(s). This sense information is used during disaster recovery to determine the currency of the R-VOL. If the host system does not support IBM PPRC, you must transfer the sense information to the remote site through the error reporting communications (ERC). If the host system supports IBM PPRC and receives PPRC-compatible sense information related to a TC390 pair, the host operating system will:

1. Temporarily suspend all application I/O operations to the M-VOL.
2. Enter an IEA491E message in the system log (SYSLOG) that indicates the time that the M-VOL was suspended. Verify that the system log is common to both the main and remote operating systems.
3. Place specific information about the failure (SIM) in the SYS1.LOGREC dataset for use by service personnel. For more information on the TC390 SIMs, see "[SIM Reporting](#)" on page 190.
4. Wait for the IEA491E message to reach the remote system.
5. Resume all host application I/O operations to the M-VOL. If the M-VOL fence level setting does not allow subsequent updates, the MCU will return a unit check for all subsequent write I/O operations and the application will terminate.



NOTE: Verify that the MCUs and RCUs are configured to report the service-level SIMs to the host. Select the **Service SIM of Remote Copy = Report** setting on the RCU Option window.

File and Database Recovery Procedures

When a TC390 Synchronous pair is suspended or when the MCU fails due to a disaster, the R-VOL may contain in-process data. A data set could be open or transactions may not have completed. Even if you use the **R-VOL Data** fence level for all TC390 Synchronous pairs, you need to establish file recovery procedures. These procedures should be the same as those used for recovering any volume that is inaccessible due to control unit failure. These procedures are more important if the **R-VOL Status** or **Never** fence level settings are used.

TC390A does not provide any procedure for detecting and retrieving lost updates. To detect and recreate lost updates, you must check other current information, such as a database journal log file that was active at the primary system when the disaster occurred. Note that the journal log file entries of most DBMS have the same system TOD clock information that is used for the I/O time-stamps (when timer type = system). The TC390A group consistency time can be extremely useful when performing this detection and retrieval. Because this detection/retrieval process can take a while, your disaster recovery scenario should be designed so that detection and retrieval of lost updates is performed after the application has been started at the secondary system.


You should prepare for file and database recovery by using:

- Files for file recovery (for example, DB2 log files that have been verified as current). To ensure the currency of these files, use the **R-VOL Data** fence level setting for the TC390 pairs that contain these important files.
- The sense information with system time stamp that will be transferred through ERC.

Remote copy and disaster recovery procedures are inherently complex. Consult your HP account team on sense-level settings and recovery procedures.

For information on recovering a pinned track on a TC390 volume, see ["Pinned Track Recovery for TrueCopy Volumes"](#) on page 189.

CSUSPEND/QUIESCE TSO Command

 **CAUTION:** The QUIESCE option of the CSUSPEND command has been disabled by APAR OW15247 or APAR OW15248. For detailed information on the QUIESCE option of the CSUSPEND command, refer to either of these APARs. Check with your HP account team before using the CSUSPEND command with the QUIESCE option to suspend TC390 volume pairs on an XP128/XP1024/XP12000 (or other XP disk array). If the CSUSPEND command with the QUIESCE option is issued to certain volumes (for example, active SPOOL, PAGE, or CATALOG datasets, or active SYSRES volume), the attached host(s) may enter a deadlock condition and may require a storage control IML to correct the condition. TC390A does not support the CSUSPEND/QUIESCE option.

IEA494I System Console Message


The IEA494I message is recommended as a trigger for automation over the IEA491E message because the IEA494I message is reported to all attached MVS hosts each time the M-VOL pair status changes, whereas the IEA491E message is reported to only one host system. For more information on the IEA494I and IEA491E messages, see ["IEA494I and IEA491E Console Messages"](#) on page 180.

Switching Operations to the Remote Site

If a disaster or failure occurs at the main site, the first disaster recovery activity is to switch your operations to the remote backup site. The TC390 Synchronous R-VOLs are recovered individually based on the pair status and M-VOL fence level information for each pair. The TC390A R-VOLs are recovered based on pair status, consistency status, and consistency time.

The basic procedures for switching operations to the remote backup site are:

1. Analyze the currency of the TC390 Synchronous R-VOLs (see ["Analyzing the Currency of TrueCopy Synchronous R-VOLs"](#) on page 150) and the consistency of the TC390A R-VOLs (see ["Analyzing the Consistency of TrueCopy Asynchronous R-VOLs"](#) on page 151).
2. Record the consistency time (C/T) of each group. The suspended TC390A R-VOLs with consistency status of *group* will indicate the same C/T.
3. Perform file recovery as needed (see ["File and Database Recovery Procedures"](#) on page 148). The C/T of each TC390A group can be used to retrieve lost updates.
4. At the remote site, suspend all pairs by issuing the CSUSPEND TSO command to the R-VOLs. This command changes the R-VOLs to the *simplex* state. Use the TC390A group and drain suspend options to destage pending updates in cache to the R-VOLs.

 **NOTE:** If PPRC is not installed, connect to each RCU and delete all TC390 pairs. For TC390A pairs, use the **C/T** delete option to delete all consistent pairs in the group at the same time. This option prevents you from accidentally using inconsistent pairs for disaster recovery. Delete all TC390 sync pairs using the **Delete by Force** and **Delete All Pairs** options.

 **CAUTION:** After an R-VOL changes to the simplex state, you cannot distinguish it from a non-TC390 simplex volume. The TC390A C/T is also discarded when the pair is deleted.

5. If necessary, use ICKDSF REFORMAT to change the labels (VOLSERs) of the R-VOLs.
6. Verify that all required file recovery procedures have been completed before varying the R-VOLs online. If an IPL of the remote host system is not required, bring the R-VOLs online. If an IPL is required:

- a. Clear the remote copy SIMs from the RCUs before OS IPL. Connect to each RCU and click **Clear SIM** in the Other Operations window (see “Other Operations” on page 118). Please note that only an HP CE or ASE should remove SIMs.
 - b. Perform IPL of the remote host system.
 - c. Wait until the IPL is complete, and then vary the R-VOLs online (if they did not come online automatically).
7. At this point you may start critical applications at the remote site with the previous R-VOLs taking the place of their M-VOLs.

Analyzing the Currency of TrueCopy Synchronous R-VOLs

The following table shows how to determine the currency of a TC390 Synchronous R-VOL based on its pair status and M-VOL fence level setting. For TC390 Synchronous pairs with an M-VOL fence level setting of **Never**, further analysis will be required to determine the currency of these R-VOLs. The currency of these R-VOLs can be determined by using the sense information transferred through ERC or by comparing the contents of the R-VOL with other files that are confirmed to be current (for example, DB2 log files). These R-VOLs should be recovered using the files that are confirmed to be current.

Table 21 Analyzing the currency of TrueCopy Synchronous R-VOLs

Status of R-VOL	Fence Level	Currency of R-VOL
Simplex	Data Status Never	Inconsistent. This R-VOL does not belong to a TC390 volume pair. Even if you established a TC390 pair for this volume, you must regard this volume as inconsistent.
Pending Duplex	Data Status Never	Inconsistent. This R-VOL is not synchronized because not all cylinders have been copied from the M-VOL yet. This R-VOL must be initialized (or copied from the M-VOL at a later time).
Duplex	Data Status	Current. This R-VOL is synchronized with its M-VOL.
	Never	Needs to be analyzed. This R-VOL requires further analysis to determine its level of currency.
Suspended - initial copy failed	Data Status Never	Inconsistent. This R-VOL is not synchronized because not all cylinders have been copied from the M-VOL yet. This R-VOL must be initialized (or copied from the M-VOL at a later time).
Suspended - R-VOL by operator	Data Status Never	Suspect. This R-VOL is not synchronized with its M-VOL if any write I/Os were issued to the M-VOL after the pair was suspended. This pair should be restarted using the Entire initial copy option, but the No Copy option can be used if you are sure no data on the M-VOL changed.
Suspended - all other types	Data	Current. This R-VOL is synchronized with its M-VOL.
	Status Never	Suspect. This R-VOL is not synchronized with its M-VOL if any write I/Os were issued to the M-VOL after the pair was suspended. Restore the consistency of this R-VOL and update it, if required. The system time stamp information transferred through ERC or the time of suspension indicated on the Pair Status window will help to determine the last time this R-VOL was updated.

Analyzing the Consistency of TrueCopy Asynchronous R-VOLs

The following table shows how to determine the consistency of a TC390A R-VOL based on its pair status and consistency status. For TC390A R-VOLs with a consistency status of **Volume**, the volume is not consistent with other volumes in the same group and further analysis will be required to determine the currency of each of these R-VOLs. To determine the currency of these R-VOLs, use the sense information transferred through ERC or compare the contents of the R-VOL with other files that are confirmed to be current, such as DB2 log files. These R-VOLs should be recovered using the files that are confirmed to be current.

Table 22 Analyzing the consistency of TrueCopy Asynchronous R-VOLs

Status of R-VOL	Usable for Recovery?	Description
Duplex Pending Duplex Simplex	No No No	These states do not usually occur during TC390A disaster recovery because the RCU suspends all TC390A pairs when communication with the MCU is lost. TC390A R-VOLs in these states should not be used for disaster recovery. Simplex volumes cannot be distinguished from R-VOLs that have already been deleted by the Delete Pair operation.
Suspended-Group	Yes	The update sequence consistency across these R-VOLs is ensured at the point in time indicated by the group consistency time. These R-VOLs can be used for disaster recovery at the secondary system. Updates that were performed at the primary system after the indicated consistency time were probably lost.
Suspended-Volume	No	The contents of this R-VOL may be behind the other R-VOLs in the consistency group. If this volume must be consistent with the other volumes in the same group, this R-VOL should not be used for disaster recovery. The cause for this status is: The TC390A Error Level pair option for this pair is Volume (not Group). Also, this pair was suspended before the disaster/failure, at the beginning of the rolling disaster, or during the initial copy operation.

Transferring Operations Back to the Main Site

After the applications are running at the remote site, the next activity is to restore the main site and transfer operations back to the main site.



NOTE: For Fibre Channel interface, do not use the CESTPATH and CDELPATH commands at the same time as the SCSI path definition function of LUN Management. The Fibre Channel interface ports need to be configured as initiator ports or RCU target ports before the CESTPATH and CDELPATH commands are issued.

To transfer operations to the main site:

1. Bring up the host system at the main (primary) site and ensure that all TC390 components are fully operational.
2. At the main site, delete all TC390 pairs at the MCUs. The **Delete Pair by Force** option must be used because the previous R-VOLs are now in the *simplex* state at the remote site. Use the **Delete All Pairs**

option to delete all TC390 sync pairs in each CU image. Use the **Delete-Group** option to delete all TC390A pairs in each group. Make sure to connect with all MCUs and all CU images to delete all TC390 pairs.

3. At the main site, delete all TC390A consistency groups at the MCUs.
4. At the main site, delete the RCUs. Remember to connect with each MCU and each CU image to verify that all RCUs have been deleted.
5. At the main site, configure the MCU ports as needed. If you plan to use the same remote copy connections to copy back, change the existing RCPs to LCPs and change the existing initiator ports to RCU target ports. If SVP mode 114 is enabled on all MCUs and RCUs, the ports will reconfigure automatically if you use the CESTPATH command to add the pairs at the secondary site.
6. If you plan to use the same channel extenders, change the operating mode to the opposite direction. The boxes/nodes connected to the MCUs must be set to channel-mode and the boxes/nodes connected to the RCUs must be set to device-mode.
7. At the remote site, configure the RCU ports to enable TC390 operations in the reverse direction (change LCPs to RCPs for serial, change RCU target ports to initiator ports for fibre). This enables the original RCUs to send TC390 remote copy operations to the original MCUs to bring the original M-VOLs up to date. If SVP mode 114 is enabled on all MCUs and RCUs, the ports will reconfigure automatically if you use the TSO CESTPATH command to add the pairs at the remote site.



CAUTION: Before issuing the CESTPATH command, verify that the relevant paths are offline from the host(s) (for example, configure the Chipid offline, deactivate the LPAR, or block the port in the ESCD). If any active logical paths still exist, the add path operation will fail because the port mode (LCP/RCP) cannot be changed.

8. At the remote site, establish the same TC390A groups and TC390 pairs in the reverse direction to synchronize the original M-VOLs with the R-VOLs. Make sure to use the **Entire** TC390 initial copy option. The following table shows the correct timer types for performing TC390A operations in the reverse direction.

Table 23 Selecting the correct timer type for TrueCopy Async disaster recovery

Original Configuration		Timer Type for Copy Back	
		I/O Time-Stamp Function at Secondary System?	
MCU-RCU Configuration	Timer Type	Yes	No
n-to-1 (n>1)	System	None	None
1-to-1	System	System	None
	Local	Local	Local

Resuming Normal Operations at the Main Site

After the TC390 pairs have been established in the reverse direction, you are ready to resume normal operations at the main site. Remember that the TC390 terminology is now reversed: the original RCUs and R-VOLs (remote site) are now the MCUs and M-VOLs, and the original MCUs and M-VOLs (main site) are now the RCUs and R-VOLs.

To resume normal operations at the main site:

1. At the remote site, verify that all TC390 pairs are in the *duplex* state. This indicates that the TC390 initial copy operations are complete.

2. Halt the applications at the remote site and vary the M-VOLs (original R-VOLs) offline at the remote site. This maintains synchronization of the TC390 Synchronous pairs.
3. At the remote site, suspend all TC390 pairs at the MCUs (original RCUs) to destage any pending data from cache. Confirm that the pairs are suspended before proceeding. If an error occurs, resolve it before proceeding.
4. At the remote site, delete all TC390 pairs at the MCUs (original RCUs) using the **Delete All Pairs** option for TC390 sync pairs and the **Delete-Group** option for TC390A pairs. For TC390A pairs, the MCU and RCU complete all pending updates before changing the pair status to *simplex*.
5. At the remote site, change the TC390 settings at the MCUs (original RCUs) to prepare for normal TC390 operations. Delete the TC390A groups and the RCUs (original MCUs). If you plan to use the same remote copy connections, reconfigure the ports (change RCPs back to LCPs for serial, change initiator ports back to ordinary target ports for fibre). If SVP mode 114 is enabled on all MCUs and RCUs, the ports will reconfigure automatically if you use the TSO CESTPATH command to add the pairs at the main site.



NOTE: For Fibre Channel interface, do not use the CESTPATH and CDELPATH commands at the same time as the SCSI path definition function of LUN Management. The Fibre Channel interface ports need to be configured as initiator ports or RCU target ports before the CESTPATH and CDELPATH commands are issued.

6. If you plan to use the same channel extenders, change the operating mode back to the original direction. The boxes/nodes connected to the MCUs must be set to channel-mode and the boxes/nodes connected to the RCUs must be set to device-mode.
7. At the main site, configure the RCPs or initiator ports, add the RCUs, and add the TC390A groups. If SVP mode 114 is enabled on all MCUs and RCUs, the ports will reconfigure automatically if you use the TSO CESTPATH command to add the pairs at the main site.



CAUTION: Before issuing the CESTPATH command, verify that the relevant paths are offline from the host(s) (for example, configure the Chipid offline, deactivate the LPAR, or block the port in the ESCD). If any active logical paths still exist, the add path operation will fail because the port mode (LCP/RCP) cannot be changed.

8. At the main site, establish all TC390A groups and TC390 pairs in the original direction. You may use the **No Copy** initial copy option because all M-VOLs and R-VOLs are synchronized. If there is any possibility that the volumes are not 100% synchronized, use the **Entire** initial copy option to be safe.
9. Vary the MCU and M-VOLs online and start the applications at the main site.

Troubleshooting

General TrueCopy Troubleshooting

In the unlikely event of a problem with the Command View management station or software, first verify that the problem is not being caused by the PC or Ethernet hardware or software, and then try restarting the PC. Restarting the Command View management station does not affect TC390 operations already in progress. For a description of the TC390 error messages displayed on the Command View management station, see ["TrueCopy Software Error Codes"](#) on page 160.



NOTE: Use the **FDCOPY** function to copy the Command View configuration information onto diskette and give the diskette(s) to HP service personnel.

The following table provides general troubleshooting information for TC390. [Table 25](#) on page 155 provides troubleshooting information for RCU paths. [Table 26](#) on page 157 and [Table 27](#) on page 159 provide troubleshooting information for suspended TC390 pairs. For troubleshooting information on TC390 scripting, see "[TrueCopy Scripting](#)" on page 195.

Table 24 General TrueCopy troubleshooting

Error	Corrective Action
TC390 operations do not function properly.	Verify that all TC390 requirements and restrictions are met (for example, track format, LVI, VOLSER, or DFW). See " System Requirements " on page 53 and " Requirements and Restrictions " on page 54. Verify the MCU and RCU are powered on and fully operational (NVS, cache, DFW). Check all input values and parameters to verify you entered the correct information on the Command View management station (for example, RCU S/N and SSID, path parameters, and M-VOL and R-VOL IDs).
The volume pairs and/or RCUs are not displaying correctly.	Verify that the correct CU image is selected.
An R-SIM warning is displayed on the Command View management station.	Locate the SIM using the RMCMAIN R-SIM window. For SIMs related to TC390 operations, see " SIM Reporting " on page 190.
A TC390 error message is displayed on the Command View management station.	Resolve the specified error condition, and then try the TC390 operation again.
There is a problem with the Command View management station or TC390.	Verify that the problem is not the PC or LAN hardware or software. Try restarting the PC and reconnecting to the disk array.
The RCU path status is not normal.	Check the path status (RCU Status window) and see Table 25 on page 155.
The pair status is <i>suspended</i> .	Check the detailed pair status (Pair Status window) and see Table 25 on page 155 and Table 26 on page 157 for suspend types and corrective action for suspended TC390 pairs.

Table 25 Troubleshooting RCU path status problems

Path Status	Description	Corrective Action
Initialization Failed	The link initialization procedure to the RCU failed.	<p>Verify that you entered the correct RCU S/N and SSID and path parameters (Fibre: MCU port, RCU port, CU number and Controller ID. Serial: port, link address and logical address).</p> <p>For serial, verify that the correct MCU port is configured as an RCP and that the correct RCU port is configured as an LCP.</p> <p>For Fibre Channel interface, verify that the Fibre Channel topology settings of the MCU and RCU ports are correct.</p>
Communication Time Out	Communication between the MCU and RCU timed out.	<p>Verify that the RCU is powered on and fully functional (NVS and cache ON).</p> <p>Verify that the remote copy connection hardware is properly configured and functional, including cables, connectors, ESCDs, repeaters, extender devices, communication lines, and all other devices connected to the extenders.</p> <p>Delete the failed path. You may need to change the minimum paths setting or delete the RCU to delete the path. Then add the path/RCU using Add Path or Add RCU.</p>
Resource Shortage (MCU/RCU)	The MCU/RCU rejected the establish logical path link control function because all logical path resources in the MCU/RCU are being used for other connections.	<p>Delete the failed path, and also delete all paths and RCUs not currently in use. The MCU can be connected to up to four RCUs with up to eight paths (four for serial 3990) to each RCU.</p> <p>Verify all MCU and RCU ports are properly configured:</p> <ul style="list-style-type: none"> • Serial – LCPs for hosts and MCUs, RCPs for RCUs. • Fibre – ordinary target ports or RCU target ports for hosts, RCU target ports for MCUs, initiator ports for RCUs. <p>If necessary, connect to the RCU to delete paths/RCUs and reconfigure ports, then reconnect to the MCU.</p> <p>Add the path/RCU again using Add Path or Add RCU.</p>

Table 25 Troubleshooting RCU path status problems (continued)

Path Status	Description	Corrective Action
Serial Number Mismatch	The RCU's S/N does not match the specified S/N.	<p>Verify that you entered the correct RCU S/N and SSID and path parameters (Fibre: MCU port, RCU port, CU number and Controller ID. Serial: port, link address and logical address).</p> <p>Delete the failed path. You may need to change the minimum paths setting or delete the RCU to delete the path. Then add the path/RCU using Add Path or Add RCU.</p> <p>For Fibre Channel interface, verify that you entered the correct Controller ID and that the Fibre Channel topology settings of the MCU and RCU ports are correct.</p>
Invalid Port	The specified port is not configured as an RCP or initiator port, or this path already exists.	<p>For serial, verify that the correct MCU port is configured as an RCP and that the correct RCU port is configured as an LCP.</p> <p>For Fibre Channel interface, verify that the Fibre Channel topology settings of the MCU and RCU ports are correct.</p> <p>Verify that you entered the correct RCU S/N and SSID and path parameters (Fibre: MCU port, RCU port, CU number and Controller ID. Serial: port, link address and logical address).</p> <p>Delete the failed path. You may need to change the minimum paths setting or delete the RCU to delete the path. Then add the path/RCU using Add Path or Add RCU.</p>
RCU Port Number Mismatch	The specified port in the RCU is physically disconnected from the MCU.	<p>Verify that you entered the correct RCU port number. Correct the port number if necessary.</p> <p>Verify that the MCU and RCU are physically connected.</p> <p>For Fibre Channel interface, verify that the Fibre Channel topology settings of the MCU and RCU ports are correct.</p>
RCU Port Type Mismatch	The specified port in the RCU is not configured as an RCU Target port.	Verify that the port in the RCU configured as an RCU Target port. Configure the port as an RCU Target port if necessary.
Communication failed.	The MCU connects to the RCU successfully, but logical communication time out occurred.	Verify that the RCU port and remote copy connection hardware (cables and switches) are properly configured and functioning.
Port Number Mismatch	The specified port number is not correct, or the cable is not connected to the specified port.	<p>Delete the error path.</p> <p>Verify that you entered the correct port number.</p> <p>Verify that the cable is connected.</p>

Table 25 Troubleshooting RCU path status problems (continued)

Path Status	Description	Corrective Action
Fibre Remote Copy is not Supported	The RCU microcode does not support fibre remote copy.	Install the microcode that supports fibre remote copy at the RCU.
Communication Error	Communication between the MCU and RCU through the fibre path timed out.	Delete the failed path.
<blank>	This path was not established.	Delete the failed path. You may need to change the minimum paths setting or delete the RCU to delete the path. Then add the path/RCU using Add Path or Add RCU.

Table 26 Troubleshooting suspended TrueCopy pairs

Suspend Type	Applies to	Description	Corrective Action
M-VOL by Operator	M-VOL	The user suspended the pair from the MCU using the M-VOL Failure option. The R-VOL suspend type is <i>by MCU</i> .	Resume the pair from the MCU.
R-VOL by Operator	M-VOL, R-VOL	The user suspended the pair from the MCU or RCU using the R-VOL option.	Resume the pair from the MCU.
by MCU	R-VOL	The RCU received a request from the MCU to suspend the pair. The M-VOL suspend type is <i>M-VOL by Operator</i> or <i>R-VOL by Operator</i> .	Resume the pair from the MCU.
by RCU	M-VOL	The MCU detected an error condition at the RCU that caused the MCU to suspend the volume pair. The R-VOL suspend type is <i>by MCU</i> .	Clear the error condition at the RCU or R-VOL. If you need to access the R-VOL, delete the pair from the RCU. If any data on the R-VOL has changed, delete the pair from the MCU and then restart the pair (Add Pair). If not, resume the pair from the MCU.
Delete Pair to RCU	M-VOL	The MCU detected that the R-VOL status changed to <i>simplex</i> because the user deleted the pair from the RCU. The pair cannot be resumed because the R-VOL does not have the <i>suspended</i> status.	Delete the pair from the MCU and then restart the pair. You should use the Entire initial copy option to resynchronize the pair. You can use the No Copy initial copy option only if no data on the M-VOL or R-VOL changed.
R-VOL Failure	M-VOL	The MCU detected an error during communication with the RCU or an I/O error during update copy. In this case, the suspend type for the R-VOL is usually <i>by MCU</i> .	Check the path status on the RCU Status window (see Table 25 on page 155). Clear any error conditions at the RCU/R-VOL. If you need to access the R-VOL, delete the pair from the RCU. If any data on the R-VOL has changed, delete the pair from the MCU and then restart the pair (Add Pair). If not, resume the pair from the MCU.

Table 26 Troubleshooting suspended TrueCopy pairs (continued)

Suspend Type	Applies to	Description	Corrective Action
MCU IMPL	M-VOL, R-VOL	The MCU could not find valid control information in its nonvolatile memory during the IMPL procedure. This error occurs only if the MCU is without power for more than 48 hours (power failure and fully discharged batteries).	Resume the pair from the MCU. The MCU will perform an entire initial copy operation in response to the resume pair request.
Initial Copy Failed	M-VOL, R-VOL	The MCU suspended this pair during the initial copy operation. The data on the R-VOL is not identical to the data on the M-VOL. Invalid track format can cause this suspension.	Delete the pair from the MCU. Clear all error conditions at the MCU, M-VOL, RCU, and R-VOL. Reformat failed track using ICKDSF. Restart the initial copy operation using the Add Pair window.
by FREEZE	M-VOL, R-VOL	All TC390 Synchronous pairs in the MCU were suspended by the CGROUP/RUN command.	Resume the pair(s) from the MCU using Resume Pair or the CESTPAIR (MODE=RESYNC) TSO command.
MCU P/S-OFF	R-VOL (TC390A)	The MCU suspended all TC390A pairs due to MCU power-off.	None. The MCU will automatically resume these TC390A pairs during power-on.
by Sidefile Overflow	M-VOL, R-VOL	The amount of sidefile exceeds the specified current pending update data rate and the RCU data is not transferred within the specified offloading timer.	Add cache memory, increase the number of paths between MCU and RCU, or decrease the number of Async pairs or host I/Os.

The following table provides troubleshooting instructions for the TC390A suspension conditions caused by the offloading timer asynchronous option, the group timeout options (copy pending and RCU ready), and

recordset errors. Hardware failures that affect the cache storage/shared memory of the MCU or RCU may also cause the TC390A volume pairs to be suspended.

Table 27 Resolving TrueCopy Asynchronous suspension conditions

Classification	Causes of Suspension	SIM	Recovery procedure
MCU/RCU hardware	<p>Hardware redundancy has been lost due to some blockade condition. As a result, MCU-RCU communication, creating or receiving recordset, or the staging or de-staging process could not complete.</p> <p>The pending recordset cannot be retained because one side of cache storage or shared memory has been blocked due to hardware failure.</p> <p>MCU-Creating/sending recordset failed due to unrecoverable hardware failure.</p> <p>RCU-Reading/Settling recordset failed due to unrecoverable hardware failure.</p> <p>The drive parity group has been in the correction-access status while the TC390 volume pair was in pending state.</p>	DB0x DB1x DB2x	<p>According to SIM, remove the hardware blockade or failure.</p> <p>Re-establish failed volume pairs (Resume Pair).</p>
MCU-RCU communication	<p>During the power-on-reset sequence, the MCU could not communicate with the RCU within the specified RCU ready timeout.</p> <p>The RCU could not settle the pending recordset or could not communicate with the MCU before the copy pending timeout due to MCU not-ready or inoperative facilities on the remote copy connections.</p>	DB0x DB1x	<p>Remove the failed condition at the RCU/MCU or on the remote copy connection.</p> <p>Re-establish failed pairs (Resume Pair).</p>
RIO overload	<p>The unrecoverable RIO (remote I/O) timeout occurred due to overload of the RCU or the communication facilities on the remote copy connections.</p> <p>No recordset could be sent within the specified copy pending timeout.</p> <p>The RCU could not settle the pending recordset before the copy pending timeout due to overload of the RIO or the RCU itself.</p>	DB1x	<p>Delete failed pairs (Delete Pair).</p> <p>Reconsider the performance resources necessary and increase resources as needed (cache amount, number of MCU-RCU paths, and so forth).</p> <p>Re-establish failed pairs (Add Pair).</p>
RIO failure	The RIO (remote I/O) could not complete due to the failure at the RCU.	DB2x	<p>According to SIM generated at the RCU, remove the failure.</p> <p>Re-establish failed pairs (Resume Pair).</p>

Table 27 Resolving TrueCopy Asynchronous suspension conditions (continued)

Classification	Causes of Suspension	SIM	Recovery procedure
MCU planned outage	The TC390A pairs were temporarily suspended due to a planned outage of the MCU.	DB8x	No recovery procedure is required. The MCU will automatically remove the suspension condition during the next power-on-reset sequence.

TrueCopy Software Error Codes

The TC390 software displays error messages on the Command View management station when error conditions occur during TC390 operations. The error message describes the error and provides a four-digit error code. The error code may include the XP128/XP1024/XP12000 SVP error code. If you need to call HP technical support for assistance, report the TC390 and SVP error codes.

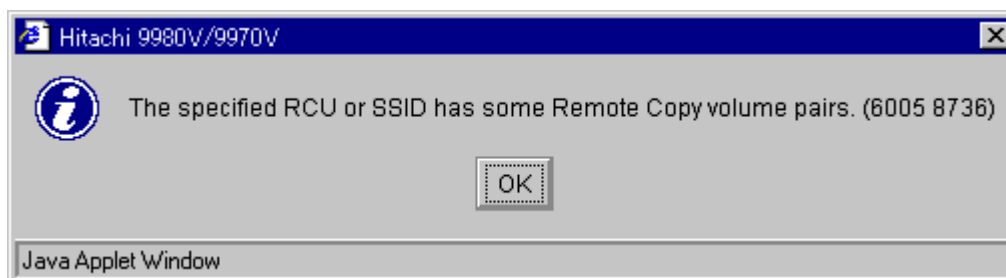


Figure 69 Example of the TC390 error message

Using PPRC Commands for TrueCopy

Overview of PPRC Commands

The XP128/XP1024/XP12000 supports IBM Peer-to-Peer Remote Copy (PPRC) TSO and ICKDSF commands to perform TC390 operations from the zSeries and S/390 host system. PPRC TSO commands are issued from the system console to the M-VOL or R-VOL of a TC390 pair. PPRCOPY ICKDSF commands are issued from JCL job cards. The TC390 feature must be installed on the XP128/XP1024/XP12000 and IBM PPRC must be installed on the host operating system. For TC390A operations, special switches and parameters are used to control and monitor TC390A pairs and groups using PPRC commands.

The following TC390 operations cannot be performed using PPRC commands: async options, and TC390A group addition/deletion. The async options and groups must be configured using the Command View management station before you can add any TC390A pairs (CESTPAIR). You also cannot change the RCU options, initial copy priority, or the DFW to R-VOL pair options using PPRC commands. For more information on the restrictions associated with using PPRC commands instead of TC390 through Command View, see ["PPRC Support"](#) on page 51.

Port configuration (LCP↔RCP, RCU target↔initiator) is supported through the CESTPATH and CDELPATH TSO commands only when SVP mode 114 ON (refer to [Table 3](#) on page 28). If SVP mode 114 is OFF, you must configure the ports using the licensed TC390 software on the Command View management station before adding paths and after deleting paths.

[Table 28](#) on page 161 lists the TC390 operations and describes the corresponding PPRC TSO and ICKDSF commands. ["Using PPRC TSO Commands with TrueCopy Asynchronous"](#) on page 163 provides instructions for using the PPRC TSO commands with TC390A pairs.



NOTE: For Fibre Channel interface, do not use the CESTPATH and CDELPATH commands at the same time as the SCSI path definition function of LUN Management. The Fibre Channel interface ports need to be configured as initiator ports or RCU target ports before the CESTPATH and CDELPATH commands are issued.

PPRC TSO command parameter support depends on the CU emulation (3990 or 2105). PPRC command extensions are supported when running with 2105 emulation.

The PPRC TSO and ICKDSF commands have required and optional parameters that are not described in detail in this chapter. These commands use slightly different command/keyword names to provide equivalent PPRC functions. For example, the **CESTPAIR** TSO command is equivalent to the **PPRCOPY ESTPAIR** ICKDSF command. This chapter describes the PPRC TSO commands.

The CESTPATH RESETHP option rejects the host I/O operations. Before you use the RESETHP option of the CESTPATH command, stop the I/O operations from the host.

Table 28 TrueCopy operations versus PPRC TSO and ICKDSF commands

TC390 Operation	TSO Command	ICKDSF Command	Command Issued to:	Description
Configure Port (LCP to RCP, or RCU target to initiator)	----		----	<p>If SVP mode 114 is OFF, the ports must be configured using the Command View management station (or SVP). If SVP mode 114 is ON, the ports are configured automatically (LCP/RCP to RCP/LCP, RCU target/initiator to initiator/RCU target) in response to the CESTPATH and CDELPATH TSO commands.</p> <p>For Fibre Channel interface, do not use the CESTPATH and CDELPATH commands at the same time as the SCSI path definition function of LUN Management. The Fibre Channel interface ports need to be configured as initiator ports or RCU target ports <i>before</i> the CESTPATH and CDELPATH commands are issued.</p>
Add RCU	CESTPATH	PPRCOPY ESTPATH	MCU	<p>Establishes logical paths from an MCU to an RCU. The default RCU options are used (see "PPRC Support" on page 51).</p> <p>For details on using CESTPATH for TC390A, see "CESTPATH" on page 164.</p>
Delete RCU	CDELPATH	PPRCOPY DELPATH	M-VOL	Deletes all active paths between an MCU and an RCU.
RCU Status	CQUERY/ PATHS	PPRCOPY QUERY/ PATHS	MCU	Displays the status of all paths for the CU specified by the DEVN parameter. TC390 supports the optional FORMAT/UNFORMAT and VOLUME/PATHS parameters.
Asynchronous Options	----	----	MCU/RCU	The default TC390A options are used (see "PPRC Support" on page 51).

Table 28 TrueCopy operations versus PPRC TSO and ICKDSF commands (continued)

TC390 Operation	TSO Command	ICKDSF Command	Command Issued to:	Description
Add Group	----	----	MCU	Must be performed using the TC390 software. The group options are selected during add group (see "Adding Consistency Groups (Add CT Group)" on page 109).
Group Status	----	----	MCU/RCU	Must be performed using the TC390 software (see "Viewing Consistency Group Status (CT Group Status)" on page 107).
Delete Group	----	----	MCU	Must be performed using the TC390 software (see "Deleting Consistency Groups (Delete CT Group)" on page 112).
Add Pair	CESTPAIR (MODE= COPY)	PPRCOPY ESTPAIR	M-VOL	Establishes a TC390 pair and sets the initial copy and pair options (copy mode = synchronous or asynchronous only, priority = 0, CFW data = copy to R-VOL, DFW to R-VOL = not required). TC390 supports the optional MODE, PACE, and CRIT parameters. The MSGREQ parameter defaults to NO (not applicable to TC390A). For details on using CESTPAIR for TC390A, see "CESTPAIR" on page 166.
Suspend Pair	CSUSPEND	PPRCOPY SUSPEND	M-VOL or R-VOL	Suspends a TC390 pair (or TC390A group). TC390 supports the optional PRIMARY parameter. See Caution below on the QUIESCE parameter. For details on CSUSPEND for TC390A, see "CSUSPEND" on page 168.
Delete Pair (to MCU)	CDELPAIR	PPRCOPY DELPAIR	M-VOL	Deletes a TC390 pair (or TC390A group) from the MCU. For details on using CDELPAIR for TC390A, see "CDELPAIR" on page 169.
Delete Pair (to RCU)	CRECOVER	PPRCOPY RECOVER	R-VOL	Deletes a TC390 pair (or TC390A group) from the RCU. For details on using CRECOVER for TC390A, see "CRECOVER" on page 170.
Pair Status	CQUERY/ VOLUME	PPRCOPY QUERY/ VOLUME	M-VOL or R-VOL	Displays the TC390 and TC390A pair status of the volume. TC390 supports the optional FORMAT/UNFORMAT and VOLUME/PATHS parameters. For details on using CQUERY for TC390A, see "CQUERY for Serial Interface" on page 171.
Resume Pair	CESTPAIR (MODE= RESYNC)	PPRCOPY ESTPAIR	M-VOL	Resumes a TC390 pair (or TC390A group), and sets the TC390 initial copy options and pair options. TC390 supports the optional MODE, PACE, and CRIT parameters. For details on using CESTPAIR/RESYNC for TC390A, see "CESTPAIR" on page 166.

Table 28 TrueCopy operations versus PPRC TSO and ICKDSF commands (continued)

TC390 Operation	TSO Command	ICKDSF Command	Command Issued to:	Description
----	P/DAS SWAP	----	M-VOL and R-VOL	Supported by TC390 Synchronous. Command is rejected by TC390A pairs. Redirects application I/Os from the M-VOL to the R-VOL. For details on using P/DAS SWAP with TC390, see "P/DAS Support" on page 52.
----	CGROUP (FREEZE/RUN)	----	MCU (M-VOL or simplex)	Supported by TC390 Synchronous. Command is rejected by TC390A pairs. For details on using CGROUP (FREEZE/RUN) with TC390 Synchronous pairs, see "CGROUP (FREEZE/RUN) Support" on page 174.



CAUTION: The QUIESCE option of the CSUSPEND command has been disabled by APAR OW15247 or APAR OW15248. For detailed information on the QUIESCE option of the CSUSPEND command, refer to either of these APARs. Check with your HP account team before using the CSUSPEND command with the QUIESCE option to suspend TC390 volume pairs on an XP128/XP1024/XP12000 (or other XP disk array). If the CSUSPEND command with the QUIESCE option is issued to certain volumes (for example, active SPOOL, PAGE, or CATALOG datasets, or active SYSRES volume), the attached host(s) may enter a deadlock condition and may require a storage control IML to correct the condition. TC390A does not support the CSUSPEND/QUIESCE option.

Using PPRC TSO Commands with TrueCopy Asynchronous

For TC390A operations, special switches and parameters are used to control and monitor TC390A pairs and groups using PPRC commands. This section describes this special use of PPRC TSO commands for TC390A volumes on the XP128/XP1024/XP12000. [Table 29](#) on page 164 describes the typographic conventions used for the PPRC TSO commands described in this section.



NOTE: PPRC TSO command parameter support depends on the emulation (for example, 2105 or 3990). PPRC command extensions are supported when running with 2105 emulation.

Use the **PPRC TSO Command** option on the Async Option window to select the XP256-compatible format for PPRC TSO commands (groups 0-F instead of 00-3F).



NOTE: The DEVSERV PATHS command displays the pair status of a TC390A volume in the **DC-STATE** box. The contents of this box are the same as for TC390 Synchronous. Note that the TC390A transition states (suspending and deleting) are not displayed.

This section does not specifically address the equivalent PPRCOPY ICKDSF commands. Use caution when issuing ICKDSF commands to TC390A volumes.

Table 29 Typographic conventions for PPRC TSO commands

Typeface/Symbol	Example	Usage
Normal text	CRIT(YES)	Command/keyword names or console outputs.
Italics	<i>ssid</i>	Parameter to be replaced with an appropriate character or numeric string.
Bold	cmd_param	Command/keyword names, parameters, or console outputs that involve/denote special meaning for TC390A.
Square brackets	[PACE(15)]	Keywords/parameters that can be omitted.
Vertical pipe	(YES|NO)	List of keywords to be selected.
Underline	(YES|<u>NO</u>)	The default keywords/parameters.
Strikethrough	[QUIESCE]	Invalid keywords/parameters for TC390A.

CESTPATH

Use the CESTPATH command to establish remote copy paths for the XP128/XP1024/XP12000 and can be used for either serial (ESCON) or Fibre Channel interface. For fibre, the RCU controller ID is specified. The syntax for the CESTPATH command is:

For 3990-3, -6 and -6E controller emulations:

```
CESTPATH DEVN(X'dev#') PRIM(X'ssid' serial#) SEC(X'ssid' serial#) LINK(X'aabbccdd')
```

For 2105 controller emulation ('lss' parameter for LCU no., CGROUP and RESETHP options):

```
CESTPATH DEVN(X'dev#') PRIM(X'ssid' serial# X'lss') SEC(X'ssid' serial# X'lss') LINK(X'aabbccdd')
[CGROUP(YES|NO) RESETHP(YES|NO)]
```



NOTE: For fibre, do not use the RESETHP option. For serial, the RESETHP option rejects host I/O operations. Before you use this option, stop the I/O operations from the host.

For 2105 emulation, use the CESTPATH CGROUP option to control freeze. Do not use the CGROUP FREEZE option. If you use the FREEZE option, the CESTPATH command will be rejected.



CAUTION: Before issuing the CESTPATH command, verify that the relevant paths are offline from the host(s) (for example, configure the Chipid offline, deactivate the LPAR, or block the port in the ESCD). If any active paths still exist, the add path operation will fail because the port mode cannot be changed.



NOTE: For Fibre Channel interface, do not use the CESTPATH and CDELPATH commands at the same time as the SCSI path definition function of LUN Management. The Fibre Channel interface ports need to be configured as initiator ports or RCU target ports before the CESTPATH and CDELPATH commands are issued.

The following table describes the CESTPATH LINK parameter for serial and Fibre Channel interface.

Table 30 CESTPATH LINK parameter for serial and Fibre Channel

LINK Parameter	Serial (ESCON) Interface	Fibre Channel Interface
aa First two digits of SAID, see Table 31 on page 166 .	FREEZE option 0x00:keep the status 0x01:Enabled 0x02:Disabled When there are several paths, the same values must be specified for all the paths.	Bit 0-3: RCU controller ID x2-xF: Number stands for RCU controller ID. (x'4' is specified.) Bit 4-7: FREEZE option x0:keep the status x1:Enabled x2:Disabled When there are several paths, the same values must be specified for all the paths.
bb Second two digits of SAID, see Table 31 on page 166 .	MCU port number (0x00-0x1f)	MCU port number (0x00-0x1f)
cc	Link Adr (0x00-0xff)	RCU port number (0x00-0x1ff)
dd	CU number (0x00-0x1f)	CU number (0x00-0x3f)

The following table gives the XP128/XP1024/XP12000 system adapter ID (SAID) values for the CESTPATH LINK parameter.

- The last two digits of the link parameter must specify the logical CU number (00-1F for an XP128/XP1024/XP12000, 00-0F for an XP256).
- For 3990 controller emulation, the first two digits can be 00, 01, or 02. This option controls freeze as follows:
 - 00 = use mode 104
 - 01 = freeze enabled
 - 02 = freeze disabled

- For 2105 emulation, the first two digits must be 00. The CGROUP option of the CESTPATH command is used to control freeze for 2105 emulation.

Table 31 SAID values for the CESTPATH LINK parameter

RCP or Initiator Port			RCP or Initiator Port		
Cluster	Port	SAID Value	Cluster	Port	SAID Value
1	CH'A'	X'0000'	2	CH'A'	X'0010'
	CH'B'	X'0001'		CH'B'	X'0011'
	CH'C'	X'0002'		CH'C'	X'0012'
	CH'D'	X'0003'		CH'D'	X'0013'
	CH'E'	X'0004'		CH'E'	X'0014'
	CH'F'	X'0005'		CH'F'	X'0015'
	CH'G'	X'0006'		CH'G'	X'0016'
	CH'H'	X'0007'		CH'H'	X'0017'
	CH'J'	X'0008		CH'J'	X'0018
	CH'K'	X'0009		CH'K'	X'0019
	CH'L'	X'000A		CH'L'	X'001A
	CH'M'	X'000B		CH'M'	X'001B
	CH'N'	X'000C		CH'N'	X'001C
	CH'P'	X'000D		CH'P'	X'001D
	CH'Q'	X'000E		CH'Q'	X'001E
	CH'R'	X'000F		CH'R'	X'001F

CESTPAIR

Table 32 on page 167 describes how to use the CESTPAIR command to establish TC390A pairs and resume TC390A pairs and groups. The syntax for the CESTPAIR command is:

For 3990-3, -6 and -6E controller emulations:

```
CESTPAIR DEVN(X'dev#') PRIM(X'ssid' cmd_param X'cca') SEC(X'ssid' serial# X'cca')
[MODE(COPY|NOCOPY|RESYNC)] [PACE(pace)] [CRIT(YES|NO)] [MSGREQ(YES|NO)]
```

For 2105 controller emulation (new 'lss' parameter for LCU number):

CESTPAIR DEVN(X'dev#') PRIM(X'ssid' **cmd_param** X'cca' X'ls') SEC(X'ssid' serial# X'cca' X'ls')
[MODE(COPY | NOCOPY | RESYNC)] [PACE(pace)] [**CRIT(YES | NO)**] [MSGREQ(YES | NO)]

Table 32 Using CESTPAIR to establish and resume TrueCopy Async pairs

Parameter	Contents	Description
cmd_param	AGnnd nn = consistency group number (00-7F) or master volume number (00-FF: for dummy pair mode). d = 0, N, or D	Without MODE(RESYNC): Specifies the consistency group number nn to which the volume pair will belong. With MODE(RESYNC): Specifies that all M-VOLs in the consistency group should be resynchronized (resumed). nn must specify the consistency group number of the addressed device or the master volume number. For dummy pair mode, nn must specify the master volume number. d specifies the delay option for command retry due to sidefile: 0 = normal delay for command retry starting at HWM (see "Graduated Delay Sidefile Management" on page 42) N = no delay time: no command retry delay due to sidefile for this pair. Use the N setting only for a limited number of critical volumes. D = dummy pair mode (nn must specify the master volume number).
	AVnnd nn = consistency group number (00-7F) or master volume number (00-FF: for dummy pair mode). d = 0, N, or D	With MODE(RESYNC): Specifies that only the addressed device should be re-synchronized. nn must specify the consistency group number of the addressed device or the master volume number. For dummy pair mode, nn must specify the master volume number. d specifies the delay option for command retry due to sidefile: 0 = normal delay for command retry starting at HWM (see "Graduated Delay Sidefile Management" on page 42) N = no delay time: no command retry delay due to sidefile for this pair. Use the N setting only for a limited number of critical volumes. D = dummy pair mode (nn must specify the master volume number).
PACE	(pace)	Specifies the pace of the initial copy operation: 1-255, default=15 tracks.
CRIT	(YES)	Specifies the Error Level (TC390A pair option) of Group.
	(NO)	Specifies the Error Level (TC390A pair option) of Volume.

- If the first digit of the **cmd_param** is other than A, the disk array interprets this command as pair establishment for TC390 Synchronous or SI390.
- The consistency group nn must be registered prior to this command. Otherwise this command will be rejected.

- When `MODE(RESYNC)` is specified, the consistency group number *n* must be the consistency group number to which the addressed device belongs. If a different number is specified, this command will be rejected.
- When `MODE(RESYNC)` is specified, the copy mode (synchronous or asynchronous) cannot be changed. If a different copy mode is specified, this command will be rejected.
- If the consistency group requirements (see “[Consistency Groups](#)” on page 57) are not satisfied, this command may/may not be rejected.
- The delay option prevents command retry delay for this pair when sidefile is above the HWM (see “[Graduated Delay Sidefile Management](#)” on page 42). If not specified correctly, command is rejected (F/M=04).
- When `cmd_param AGxxx` is specified, this command ends *before* the actual pair establishment/re-establishment successfully starts. Confirmation by CQUERY or IEA494I console message is recommended after this command.
- The dummy pair for each primary volume can be established only by the PPRC command. For the use of dummy pair, note the following:
 - Use the dummy pair only for a limited number of the critical volumes.
 - The dummy pair function is only for ESCON-connected TC390A pairs.
 - Up to three dummy pairs can be specified for one master pair.
 - The dummy pair should be an actual volume that has the same CU number as the master pair.
 - The dummy pair should be offline from each host.
 - The dummy pair cannot be used as a user volume.
 - Establish the master pair before establishing the dummy pair.

CSUSPEND

[Table 33](#) on page 169 describes how to use the CSUSPEND command to suspend TC390A pairs and groups. The syntax for the CSUSPEND command is:

For 3990-3, -6 and -6E controller emulations:

```
CSUSPEND DEVN(X'dev#') PRIM(X'ssid' cmd_param X'cca') SEC(X'ssid' serial# X'cca') [PRIMARY]-  
[QUIESCE]
```

For 2105 controller emulation, addressed device is M-VOL (new 'lss' parameter for LCU no.):

```
CSUSPEND DEVN(X'dev#') PRIM(X'ssid' cmd_param X'cca' X'lss') SEC(X'ssid' serial# X'cca' X'lss')  
[PRIMARY] [QUIESCE]
```

For 2105 controller emulation, addressed device is R-VOL (new 'lss' parameter for LCU no.):

```
CSUSPEND DEVN(X'dev#') PRIM(X'ssid' cmd_param X'cca' X'lss') SEC(X'ssid' serial# X'cca' X'lss')  
[PRIMARY] [QUIESCE]
```




NOTE: If you need write access to an R-VOL, you must delete the pair (CDELPAR).

Table 33 Using CSUSPEND to suspend TrueCopy Async pairs

Parameters	Contents	Description
cmd_param	AGD00	Specifies that all the volume pairs in the consistency group should be suspended after all pending recordsets are settled (Drain suspend option).
	AGP00	Specifies that all the volume pairs in the consistency group should be suspended. Pending recordsets are not always settled before suspension (Purge suspend option).
	AVD00	Specifies that only addressed volume pair should be suspended after the pending recordset for addressed volume settled (Drain suspend option).
	AVP00	Specifies that only the addressed volume pair should be suspended. Pending recordsets for addressed volume are not always settled (Purge suspend option).
PRIMARY		Invalid keyword for TC390A volume pairs.
QUIESCE		Invalid keyword for TC390A volume pairs.

*If the addressed device is the M-VOL, only TC390A pairs in the same disk array are suspended. Volume pairs whose M-VOLs are behind other MCUs are not affected.

- If the first digit of the **cmd_param** is other than A, the disk array interprets this command as pair suspension for TC390 Synchronous or SI390.
- The D and P in **cmd_param** stand for the Drain and Purge options, respectively. For a detailed description of these TC390A suspend options, see "[Suspending TrueCopy Pairs \(Suspend Pair\)](#)" on page 132.
- When P (**Purge**) is specified, it is not possible to determine exactly which recordset will be settled before the addressed volume pair is suspended.
- Regardless of the number of volume pairs to be suspended, this command ends *before* the actual pair suspension is successfully completed. Confirmation by CQUERY or IEA494I console message is recommended after this command.

CDELPAR

The following table describes how to use the CDELPAR command to delete TC390A pairs and groups at the MCU. The syntax for the CDELPAR command is:

For 3990-3, -6 and -6E controller emulations:

```
CDELPAR DEVN(X'dev#') PRIM(X'ssid' cmd_param X'cca' X'ls')
```

For 2105 controller emulation (new 'lss' parameter for LCU number):

CDELPAR DEVN(X'dev#') PRIM(X'ssid' **cmd_param** X'cca' X'ls') SEC(X'ssid' serial# X'cca' X'ls')

Table 34 Using CDELPAR to delete TrueCopy Async pairs/groups at the MCU

Parameters	Contents	Description
cmd_param	AG000	Specifies that all pairs in the consistency group* should be deleted. All pending recordsets will be settled before deleting the volume pairs.
	AV000	Specifies that only the addressed pair should be deleted. All pending recordsets for the addressed volume will be settled before deleting the volume pair.

*Only TC390A pairs in the same disk array are deleted. Volume pairs whose M-VOLs are behind other MCUs are not affected.

- If the first digit of the **cmd_param** is other than A, the disk array interprets this command as pair deletion for TC390 Synchronous or SI390.
- The specified pair(s) will be deleted regardless of their pair status. After the pair(s) is/are deleted, the volume(s) will not indicate their pair status before pair deletion. To delete TC390A pairs with their update sequence consistency ensured:
 - Issue the CSUSPEND command with **cmd_param** of AGP00 or AGD00.
 - Issue CQUERY to confirm that the specified pairs have been successfully suspended with the consistency status of **Group**.
 - Issue the CDELPAR command.
- Regardless of the number of volume pairs to be deleted, this command ends *before* the actual pair deletion is successfully completed. Confirmation by CQUERY or IEA494I console message is recommended after this command.

CRECOVER

The following table describes how to use the CRECOVER command to delete TC390A pairs and groups at the RCU. The syntax for the CRECOVER command is:

For 3990-3, -6 and -6E controller emulations:

```
CRECOVER DEVN(X'dev#') PRIM(X'ssid' cmd_param X'cca') SEC(X'ssid' serial# X'cca'
{ID{old_volser}[new_volser]})
```

For 2105 controller emulation (new 'ls' parameter for LCU number):

```
CRECOVER DEVN(X'dev#') PRIM(X'ssid' serial# X'cca' X'ls') SEC(X'ssid' cmd_param X'cca' X'ls')
[[ID(old_volser[new_volser]]]
```

Table 35 Using CRECOVER to delete TrueCopy Async pairs/groups at the RCU

Parameters	Contents	Description
cmd_param	AC000	AC000Specifies that all volume pairs (R-VOLs) in the consistency group whose consistency status is Suspended-Group should be deleted.
	AGP00	AG000Specifies that all volume pairs (R-VOLs) in the consistency group should be deleted regardless of pair status and consistency status. All pending recordsets will be settled before deleting the pairs.
	AVD00	AV000Specifies that the addressed volume pair (R-VOL) should be deleted regardless of pair status and consistency status. All pending recordsets for the addressed pair will be settled before deleting the pair.
[[ID(old_volser[new_volser]]]		TC390A does not support this keyword. Depending on the timing, the write command to change the volume serial number may be rejected.

- The addressed device must be the R-VOL.
- If the first digit of the **cmd_param** is other than A, the disk array interprets this command as pair deletion for TC390 Synchronous or SI390.
- Regardless of the number of volume pairs to be deleted, this command ends *before* the actual pair deletion is successfully completed. Confirmation by CQUERY or IEA494I console message is recommended after this command.

CQUERY for Serial Interface

The CQUERY command can be issued to a TC390A pair to determine its detailed pair status as well as its TC390A pair and group options. The following example shows the output of the CQUERY command with the VOLUME parameter issued to a TC390A M-VOL.



NOTE: When the controller emulation type is 3990, the CQUERY command only displays the path types and path status of the first four paths, even if more than four paths have been added.

CQUERY Output Example: M-VOL/FORMAT/VOLUME

```
***** PPRC REMOTE COPY CQUERY - VOLUME *****
*
*                                     (PRIMARY)   (SECONDARY) *
*                                     SSID CCA     SSID CCA     *
* *DEVICE   LEVEL       STATE   PATH STATUS SERIAL#   SERIAL#   *
* -----
* 0A32  PRIMARY..  PENDING...  ACTIVE..    7700 32    7740 12    *
*          CRIT(NO)                                A00SNG030982 000000030954 *
* PATHS SAID/DEST STATUS: DESCRIPTION *
* -----
* 1      001D 0000 01    PATH ESTABLISHED... *
*          ---- ---- 00NO PATH..... *
*          ---- ---- 00NO PATH..... *
*          ---- ---- 00NO PATH..... *
* IF STATE = PENDING/SUSPEND: FIRST CYL OUT OF SYNC = 00117 *
*                                     LAST CYL OUT OF SYNC = 03338 *
*                                     PERCENT OF COPY COMPLETE = 004% *
*****
```

The **CRIT** box is not used for TC390A (NO is always indicated).

The **FIRST/LAST CYL OUT OF SYNC** and **PERCENT OF COPY COMPLETE** boxes indicate the first/last cylinder number and percentage of cylinders (including R-VOL cylinders) to be copied for pair resynchronization. For a more detailed description, see ["Resuming TrueCopy Volume Pairs \(Resume Pair\)"](#) on page 134.

The **PATHS**, **SSID**, **DEST**, **STATUS**, and **DESCRIPTION** boxes show NO PATH for this volume pair instead of the actual path status. CQUERY with PATHS keyword provides the path status for this volume pair.

The following example shows the output of the CQUERY command with the VOLUME parameter issued to a TC390A R-VOL.

CQUERY Output Example: R-VOL/FORMAT/VOLUME

```
***** PPRC REMOTE COPY CQUERY - VOLUME *****
*
*                                     (PRIMARY)   (SECONDARY) *
*                                     SSID CCA     SSID CCA     *
* *DEVICE   LEVEL       STATE   PATH STATUS SERIAL#   SERIAL#   *
* -----
* 0B12  SECONDARY  SUSPEND(5)  ACTIVE..    7700 32    7740 12    *
*          .....                                A00SGG030954 *
* PATHS SAID/DEST STATUS: DESCRIPTION *
* -----
* 0      ---- ---- 00    NO PATH..... *
*          ---- ---- 00    NO PATH..... *
*          ---- ---- 00    NO PATH..... *
*          ---- ---- 00    NO PATH..... *
* SECONDARY WAS SUSPENDED (YMD/GMT): 1998-10-17 14.18.12.242451 *
*****
```

The **SECONDARY WAS SUSPENDED (YMD/GMT)** box displays the consistency time of this pair if the pair status is Suspended or Duplex. For more information on the TC390A consistency time, see "[Group Consistency Time](#)" on page 45.

If the timer type for the consistency group is System, the RCU indicates the content of the time-stamp given by the primary system with no modification.

CQUERY for Fibre Channel Interface

The path types and path status for Fibre Channel remote copy connections can be displayed by the CQUERY command. The RCU controller ID can also be displayed.

The following example shows the output of the CQUERY command and [Table 36](#) on page 174 describes the parameters used in the example for both serial and Fibre Channel interface.



NOTE: When the controller emulation type is 3990, the CQUERY command only displays the path types and path status of the first four paths, even if more than four paths have been added.

Output Example: CQUERY

```
***** PPRC REMOTE COPY CQUERY - VOLUME *****
*
*                                     (PRIMARY)   (SECONDARY) *
*                                     SSID CCA     SSID CCA     *
* *DEVICE   LEVEL      STATE    PATH STATUS SERIAL#    SERIAL#    *
* -----
* 0A32     PRIMARY..   PENDING... ACTIVE..    7700 32    7740 12    *
*          CRIT(NO)                                A00SNG030982 000000030954 *
* PATHS SAID/DEST STATUS: DESCRIPTION
* -----
* 1       001D 0000 01    PATH ESTABLISHED...
*          ---- ---- 00    NO PATH.....
*          ---- ---- 00    NO PATH.....
*          ---- ---- 00    NO PATH.....
* IF STATE = PENDING/SUSPEND:  FIRST CYL OUT OF SYNC = 00117
*                                LAST CYL OUT OF SYNC = 03338
*                                PERCENT OF COPY COMPLETE = 004%
*****
```

Table 36 CQUERY output for serial and Fibre Channel

LINK Parameter	Serial (ESCON) Interface	Fibre Channel Interface
aa	FREEZE option 0x00:keep the status 0x01:Enabled 0x02:Disabled	Bit 0-3: RCU controller ID x2-xF: Number stands for RCU controller ID. Bit 4-7: FREEZE option x0:keep the status x1:Enabled x2:Disabled
bb	MCU port number (0x00-0x1f)	MCU port number (0x00-0xff)
cc	Link Adr (0x00-0xff)	RCU port number (0x00-0xff)
dd	CU number (0x00-0x1f)	CU number (0x00-0xff)

CGROUP (FREEZE/RUN) Support

The TC390 feature supports the CGROUP (FREEZE/RUN) TSO command for PPRC, which is also used in IBM's Geographically Dispersed Parallel Sysplex (GDPS) environment. The CGROUP TSO command is used to control I/O operations for TC390 Synchronous pairs on a specific MCU-RCU pair. The CGROUP command is supported for the XP128/XP1024/XP12000 (and other XP disk arrays) functioning as TC390 MCUs. The XP disk arrays provides all required host reporting for CGROUP operations (for example, IEA494I with extended long busy (ELB) state), which is a key component of GDPS operations. For disaster recovery implementations, you must use the XP128/XP1024/XP12000 at both sites because the RCUs will become MCUs in the event of a disaster.

The CGROUP command has two parameters, FREEZE and RUN. The CGROUP/FREEZE command stops all host I/O operations to the specified TC390 M-VOLs as well as all TC390 update copy operations to their associated R-VOLs. The CGROUP/RUN command changes the pair status to *suspended* and allows the M-VOLs to start accepting host I/Os.



NOTE: For 2105 controller emulation, do not use the FREEZE option. Use the CGROUP option of the CESTPATH command (see "CESTPATH" on page 164).



CAUTION: The XP128/XP1024/XP12000 executes the CGROUP command on TC390 Synchronous pairs. TC390A does not support the CGROUP TSO command. If CGROUP is issued to a TC390A volume, the XP128/XP1024/XP12000 will reject the command. CGROUP (FREEZE/RUN) operations on TC390 Synchronous pairs do not affect TC390A pairs in any way.

Requirements

The CGROUP command can be issued only to a TC390 Synchronous M-VOL or a simplex volume in the MCU. If CGROUP is issued to a TC390 R-VOL, the RCU will reject the CGROUP command (F/M=0F, TC390 error code=58). The CGROUP command must be issued to each logical CU image of the MCU, unless the XP128/XP1024/XP12000's mode 64 (see description below) is enabled.

The requirements for CGROUP (FREEZE/RUN) support are:

- **MCU:** The MCUs to which the CGROUP command will be issued must be XP128/XP1024/XP12000s (all-mainframe and multiplatform disk arrays are both supported). For disaster recovery implementations, you must use the XP128/XP1024/XP12000 at both sites because the RCUs will become MCUs in the event of a disaster.
- **PPRC:** The host systems at the main and remote sites must have IBM PPRC support as well as the PPRC ERP PTF installed. ICKDSF does not support the CGROUP command.
- **SSIDs:** The MCUs to which the CGROUP command will be issued must have consecutive SSIDs. The HP representative configures the SSIDs on the XP128/XP1024/XP12000 SVP.



CAUTION: MVS requires that the disk array be offline during SSID changes. Reconfiguring SSIDs is therefore a disruptive event that must be carefully planned.

- **FREEZE Option (3990 only):** The FREEZE option must be enabled on the MCUs to which the CGROUP command will be issued. If not enabled, the MCU will reject the CGROUP TSO command. The FREEZE option is enabled using the Command View management station (RCU Option window). Enable the FREEZE option only after adding all MCU-RCU paths.



NOTE: Mode 104 (see below) changes the default FREEZE option from disabled to enabled. Mode 104 is invalid for 2105 emulation.

For 2105 controller emulation, do not use the FREEZE option. Use the CGROUP option of the CESTPATH command (see "CESTPATH" on page 164).

The definition of the **LINK Parameter for the CESTPATH command** will be expanded to specify the FREEZE option on an **LCU pair basis**. The FREEZE option set by the CESTPATH command is effective until another CESTPATH command that specifies the same LCU pair but a different FREEZE Option is issued. The command syntax and parameter definitions are as follows (3990 only):

```
CESTPATH PRIM(x'ssid' serial#) SEC(x'ssid' serial#) LINK(x'pppplcc', 'pppplcc',...) DEVN(x'1234')
```

where:

pppp = ESCON or Fibre Channel port ID of the primary CU (MCU) from which the TC390 paths should be established and the FREEZE option for the LCU pair. Note that the first two digits (FREEZE option) must be the same in a series of link parameters.

For ESCON cable

Value	Port ID	Freeze Option
X'0000'X'001F'	Interface 1A-2R	Default
X'0100'X'011F'	Interface 1A-2R	Enabled
X'0200'X'021	F'Interface 1A-2R	Disabled

For Fibre Channel cable:

Value	Port ID	Freeze Option
X'4000'X'40FF'	Interface 1A-GR	Default

X'4100'-X'41FF	Interface 1A-GR	Enabled
X'4200'-X'42FF'	Interface 1A-GR	Disabled

//= For ESCON cable: ESCON destination link address. The destination port number of ESCD must be specified if the TC390 link is connected through an ESCD dynamic connection. Otherwise, "00" must be specified.

For Fibre Channel cable: Fibre Channel port ID of the secondary CU (RCU) from which the paths of the TC390 should be established.

cc = LCU number of the secondary CU (RCU).

The parameters may be described in the GDPS DASD configuration list. The required link parameter values must be written into the list or must be given to RCMF input.

- **Mode 59 (HXRC only):** Mode 59 must be ON for HXRC (activates variable RECSET size to provide performance improvement).
- **Mode 64 (optional):** Mode 64 extends the range of the CGROUP command to the entire MCU instead of just one logical CU image. When mode 64 is enabled, one CGROUP command to any M-VOL or simplex volume in the MCU is executed across all MCU-RCU paths and on all TC390 M-VOLs in the specified MCU, including all CU images (CU0-CU3). When mode 64 is disabled, you must issue a separate CGROUP command to an M-VOL (or simplex volume) in each logical CU image of the MCU. Although this mode can be enabled nondisruptively (that is, existing TC390 pairs do not have to be deleted), mode 64 should be enabled at the same time that mode 49 is enabled.



NOTE: For operations in a GDPS environment, mode 64 must be OFF.

- **Mode 104 (3990 only):** Mode 104 changes the default FREEZE option to *enabled*. This mode should be enabled when CGROUP is being used in the GDPS environment. When mode 104 is enabled, the FREEZE option will remain enabled after the XP128/XP1024/XP12000 is powered off and then back on (for example, due to some disaster). When mode 104 is not enabled, the FREEZE option will revert to the default value of *disabled* after the XP128/XP1024/XP12000 is powered off and back on.



NOTE: For operations in a GDPS environment, mode 104 must be ON.

Mode 104 is invalid for 2105 emulation.

For more information on XP128/XP1024/XP12000 SVP modes related to TC390 (and HXRC) operations, refer to [Table 3](#) on page 28.

CGROUP (FREEZE/RUN) Command

The CGROUP TSO command specifies all of the following:

- The device (LDEV ID of TC390 M-VOL or simplex volume) (DEVN parameter).
- The MCU (S/N and lowest SSID in CU image) (PRIM parameter).
- The RCU (S/N and lowest SSID in CU image) (SEC parameter).

The CGROUP TSO command has the following two options:

- **FREEZE (3990 only):** When CGROUP is issued with the FREEZE option, the MCU:

- Blocks the logical path(s) between the specified MCU CU image and RCU CU image to stop all TC390 update copy operations to the R-VOLs in the specified RCU.
- Presents state change pending (SCP) with extended long busy status to host I/O requests, which causes the host to queue I/Os for the M-VOLs. SCP is indicated until the CGROUP/RUN command is issued or until the SCP delay time expires.



NOTE: After all logical MCU-RCU paths are established, make sure to specify the SCP delay time (0-600 seconds) for the MCU using the RCU Option window. To register the SCP delay time, select **OK** to close the RCU Option window, even if you did not make any changes.

If the specified MCU does not have any TC390 M-VOLs, the FREEZE command is executed without performing any operations (paths are not blocked, SCP is not indicated).

For 2105 emulation, use the CESTPATH CGROUP option to control freeze.

- **RUN:** When CGROUP is issued with the RUN option, the MCU:
 - Suspends all TC390 pairs with M-VOLs on the specified MCU CU image.
 - Presents a state-change-interrupt (SCI) to the host(s) so that the host(s) re-issue the I/Os that were waiting while the M-VOLs were in the SCP state.
 - Changes the TC390 M-VOL fence level to **Never** (PPRC CRIT=NO) so that the suspended M-VOLs accept host write I/O operations.

The following table shows the TC390 pair status for TC390 M-VOLs and R-VOLs during CGROUP (FREEZE/RUN) operations.

Table 37 TrueCopy pair status during CGROUP (FREEZE/RUN) operations

	Before CGROUP (FREEZE/RUN)		After CGROUP/FREEZE		After CGROUP/RUN	
	M-VOL	R-VOL	M-VOL	R-VOL	M-VOL	R-VOL
TC390 Pair Status	Simplex	---	Simplex	---	Simplex	---
	Pending	Pending	Pending	Pending	Suspended	Pending
	Duplex	Duplex	Duplex	Duplex	Suspended	Duplex
	Suspended	Suspended	Suspended	Suspended	Suspended	Suspended

Using the CGROUP Command

The following figure shows a simplified operational example of the CGROUP (FREEZE/RUN) command implemented in a GDPS environment. The CGROUP (FREEZE/RUN) TSO command can be issued by the user or through automation (such as GDPS) to perform the following sequence of actions:

1. Suspend host updates to all TC390 M-VOLs on the specified MCU.
2. Block the specified MCU-RCU path to stop update copy operations to the R-VOLs.
3. Change all TC390 M-VOLs on the specified MCU to suspended.
4. Resume host updates to the suspended M-VOLs.
5. The add RCU operation (CESTPATH) must be performed to re-establish the blocked logical paths. After the MCU-RCU path is re-established, the resume pair operation (CESTPAIR/RESYNC) must be performed to resume the suspended pairs.

For the following figure:

1. Read/write I/Os are issued from the host.
2. A failure occurs on a TC390 M-VOL and the MCU suspends the pair.
3. Suspend and extended long busy state are reported to the host.
4. Host reports IEA494I with extended long busy state.
5. CGROUP/FREEZE commands are issued to groups.
6. SCP sense bytes are reported if an I/O is issued to a frozen volume.
7. I/Os are queued at the host.
8. Switch to remote (secondary) site.

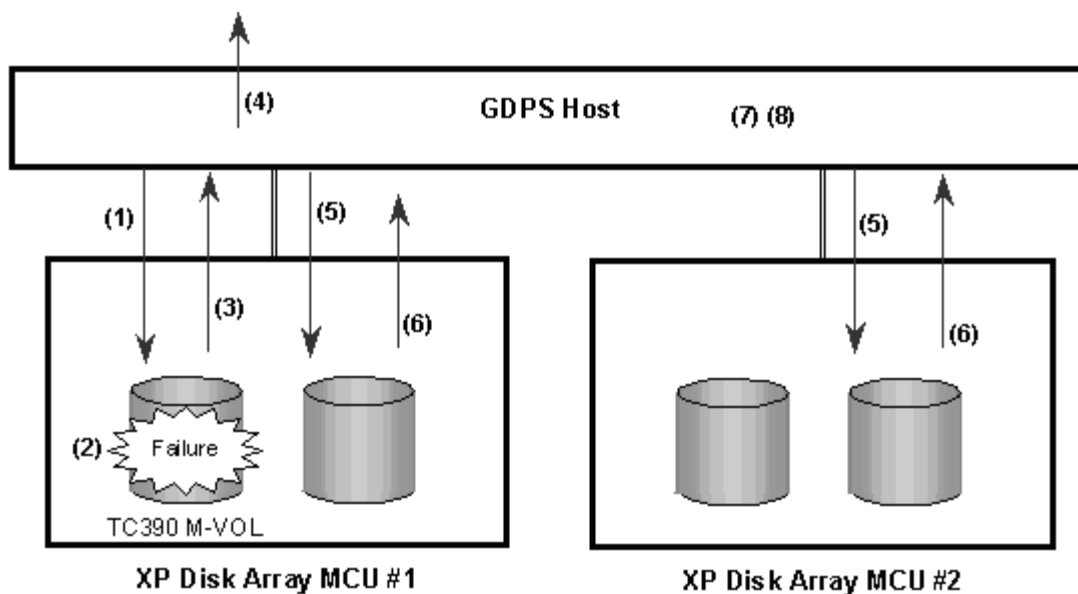


Figure 70 Overview of GDPS operations

Using PPRC TSO Commands with CGROUP Support

CESTPATH. You can use the CESTPATH command to recover a blocked MCU-RCU path. Make sure to use the same parameters as when the path was established.

CESTPAIR. After you re-establish the MCU-RCU path that was blocked, you can use the CESTPAIR/RESYNC command to resume the TC390 pairs suspended by the CGROUP/RUN command.

CDELPAIR. After you re-establish the MCU-RCU path that was blocked, you can use the CDELPAIR command to delete the TC390 pairs suspended by the CGROUP/RUN command. If CDELPAIR is issued to a TC390 pair whose MCU-RCU path is still blocked, the MCU rejects the command (F/M=0F, TC390 error code=5A).

CRECOVER. You can use the CRECOVER command to change a suspended R-VOL to simplex. This command is issued to the R-VOL and does not affect the suspended M-VOL.

CQUERY/PATHS. The following example shows the output of the CQUERY command issued to a TC390 MCU to which the CGROUP/FREEZE command has been issued.

CQUERY Output Example: M-VOL/Paths/Format

```

***** PPRC REMOTE COPY CQUERY - PATHS *****
* PRIMARY UNIT: SERIAL#= 000000090217  SSID= 00F8 *
*          FIRST          SECOND          THIRD          FOURTH *
*          SECONDARY      SECONDARY      SECONDARY      SECONDARY *
*SERIAL NO: 000000090217  ..... *
*          SSID:          00F8          0000          0000          0000 *
*          PATHS:          1            0            0            0 *
*          SAID DEST S*  SAID DEST S*  SAID DEST S*  SAID DEST S* *
*          ----- --  ----- --  ----- --  ----- -- *
*          1: 0020 FF04 10  ---- ---- 00  ---- ---- 00  ---- ---- 00 *
*          2: ---- ---- 00  ---- ---- 00  ---- ---- 00  ---- ---- 00 *
*          3: ---- ---- 00  ---- ---- 00  ---- ---- 00  ---- ---- 00 *
*          4: ---- ---- 00  ---- ---- 00  ---- ---- 00  ---- ---- 00 *
*
* S* = PATH STATUS: *
* 00=NO PATH          01=ESTABLISHED          02=INIT FAILED *
* 03=TIME OUT          04=NO RESOURCES AT PRI 05=NO RESOURCES AT SEC *
* 06=SERIAL# MISMATCH 07=(RESERVED)          08=(RESERVED) *
* 09=(RESERVED)        10=CONFIGURATION ERROR *
*****

```

The following example shows the output of the CQUERY command issued to the TC390 RCU that has a blocked path due to the CGROUP/FREEZE command.

CQUERY Output Example: R-VOL/Paths/Format

```

***** PPRC REMOTE COPY CQUERY - PATHS *****
* PRIMARY UNIT: SERIAL#= .....  SSID= 0000 *
*          FIRST          SECOND          THIRD          FOURTH *
*          SECONDARY      SECONDARY      SECONDARY      SECONDARY *
*SERIAL NO: 000000090217  ..... *
*          SSID:          00F8          0000          0000          0000 *
*          PATHS:          1            0            0            0 *
*          SAID DEST S*  SAID DEST S*  SAID DEST S*  SAID DEST S* *
*          ----- --  ----- --  ----- --  ----- -- *
*          1: 0020 FF04 10  ---- ---- 00  ---- ---- 00  ---- ---- 00 *
*          2: ---- ---- 00  ---- ---- 00  ---- ---- 00  ---- ---- 00 *
*          3: ---- ---- 00  ---- ---- 00  ---- ---- 00  ---- ---- 00 *
*          4: ---- ---- 00  ---- ---- 00  ---- ---- 00  ---- ---- 00 *
*
* S* = PATH STATUS: *
* 00=NO PATH          01=ESTABLISHED          02=INIT FAILED *
* 03=TIME OUT          04=NO RESOURCES AT PRI 05=NO RESOURCES AT SEC*
* 06=SERIAL# MISMATCH 07=(RESERVED)          08=(RESERVED) *
* 09=(RESERVED)        10=CONFIGURATION ERROR *
*****

```

CQUERY/VOLUME. The following example shows the output of the CQUERY command issued to a TC390 M-VOL that has been suspended by the CGROUP/RUN command. As shown in the example, CQUERY issued to an M-VOL also indicates the status of the FREEZE option: CGRPLB(YES) = enabled, CGRPLB(NO) = disabled.

CQUERY Output Example: M-VOL/Volume/Format

```
***** PPRC REMOTE COPY CQUERY - VOLUME ***** TC390 M-VOL is
*
*                               (PRIMARY)   (SECONDARY) * suspended by
*                               SSID CCA     SSID CCA     * CGROUP/RUN.
*DEVICE    LEVEL      STATE    PATH STATUS  SERIAL#    SERIAL#    *
*-----    -
* 0F80     PRIMARY..  SUSPEND(A)  INACTIVE   00F8 00    00F8 02    * FREEZE option
*          CRIT(NO)..... CGRPLB(YES) 000000090217 000000090217 * is enabled.
* PATHS SAID/DEST STATUS: DESCRIPTION * Logical path
* ----- * is blocked by
* 1      0020 FF04    10    CONFIGURATION ERROR * CGROUP/FREEZE.
*          ---- ----    00    NO PATH..... *
*          ---- ----    00    NO PATH..... *
*          ---- ----    00    NO PATH..... *
*
*                               PERCENT OF COPY COMPLETE = 100% *
*****
```

The following example shows the output of the CQUERY command issued to a TC390 R-VOL whose M-VOL has been suspended by the CGROUP/RUN command. The pair status and path status at the RCU are not changed.

CQUERY Output Example: R-VOL/Volume/Format

```
***** PPRC REMOTE COPY CQUERY - VOLUME ***** No change to
*
*                               (PRIMARY)   (SECONDARY) * R-VOL pair
*                               SSID CCA     SSID CCA     * status.
*DEVICE    LEVEL      STATE    PATH STATUS  SERIAL#    SERIAL#    *
*-----    -
* 0F82     SECONDARY  DUPLEX....  ACTIVE..   00F8 00    00F8 02    * No change to
*          ..... path status.
*          ..... 000000090217 *
* PATHS SAID/DEST STATUS: DESCRIPTION *
* ----- *
* 1      0020 FF04    10    CONFIGURATION ERROR *
*          ---- ----    00    NO PATH..... *
*          ---- ----    00    NO PATH..... *
*          ---- ----    00    NO PATH..... *
*
*****
```

IEA494I and IEA491E Console Messages

When a TC390 pair is suspended, whether user-requested or due to failure, the MCU generates sense information to notify the host(s). If the PPRC ERP PTF is installed and **PPRC Support = Yes** is selected on the RCU option window, this notification results in an IEA494I system console message as well as an IEA491E message. The IEA491E message indicates the reason for suspension. The IEA494I and IEA491E messages are generated by the zSeries and S/390 host based upon SSBs (sense bytes) from the disk array and not

SIMs from the disk array. Therefore, SIMs reported by the disk array to the host are not used by the GDPS scripting.

The IEA494I message is recommended as a trigger for automation over the IEA491E message. The IEA491E message is reported to only one host system, whereas the IEA494I message is reported to all attached MVS hosts each time the M-VOL pair status changes. GDPS uses the IEA494I message with extended long busy as a trigger for CGROUP (FREEZE/RUN).



NOTE: If **PPRC Support = No** is selected on the RCU Option window, the host generates the system console message that includes the SIM instead of the IEA494I or IEA491E message.

IEA494I Message

Whenever a TC390 pair status changes, with the exception of the TC390A transition states *suspending* and *deleting*, the MCU reports state-change-interrupt (SCI) to all hosts. In response to the SCI, the IEA494I system console message is generated (if supported by the host). The XP128/XP1024/XP12000 reports SCI for both online and offline devices, but the host system does not generate console messages for offline devices. Therefore, the IEA494I message is never generated with a TC390 R-VOL device address. The following figure shows an example of an IEA494I message.

- The XP128/XP1024/XP12000 MCU reports SCI for all TC390A pairs whose status has changed, regardless of the Group/Volume option of the suspend or delete pair operation (if the status change was user-requested).
- The XP128/XP1024/XP12000 MCU reports SCI for all TC390 M-VOLs (synchronous only) that are in the SCP state due to the CGROUP/FREEZE command. As shown in the following figure, this IEA494I message indicates the extended long busy state.
- The XP128/XP1024/XP12000 MCU reports SCI for all TC390 M-VOLs (synchronous only) that are suspended due to the CGROUP/RUN command. This IEA494I message indicates the extended long busy state.
- When the FREEZE option is enabled, the XP128/XP1024/XP12000 MCU reports SCI for a TC390 pair that is suspended due to a failure. When the host supports GDPS, this IEA494I message with extended long busy triggers the CGROUP (FREEZE/RUN) command.

Output Example: IEA494I Message with Extended Long Busy State

```
IEA494I 0FC3,RD0FC3,PPRC PAIR SUSPENDING,SSID=0FC0,CCA=03,EXTENDED LONG BUSY STATE
```

IEA491E Message

When a TC390 pair is suspended due to a failure, the XP128/XP1024/XP12000 MCU reports SCI as well as unit check status and sense bytes with F/M = FB. In response to the F/M=FB sense bytes, the IEA491E system console message is generated (if supported by the host). The following figure shows an example of an IEA491E message.



NOTE: If the host supports GDPS and the FREEZE option is enabled, the IEA494I system console message with extended long busy, which was generated in response to the SCI, triggers the CGROUP (FREEZE/RUN) command.

Output Example: IEA491E Message

```
IEA491E DSLFC0,PPRC SUSPENDED, SECONDARY NOT READY, INTERVENTION_REQUIRED,  
(PRI)SER=0113-90797,CCA=00 (SEC)SER=0113-90217,CCA=
```

XP128/XP1024/XP12000 Response Characteristics to Failure Conditions

The XP128/XP1024/XP12000 supports the CGROUP command in the GDPS environment by performing PPRC-compatible actions and returning PPRC-compatible messages to failure conditions. The following figure shows the failure conditions and the following table describes the response characteristics of the XP128/XP1024/XP12000 to these failure conditions.



NOTE: The **PPRC Support=Yes** option must be selected on the RCU option window (see “[Registering an RCU \(Add RCU\)](#)” on page 93). If not, the host processor generates the system console message that includes the SIM instead of the IEA494I or IEA491E message.

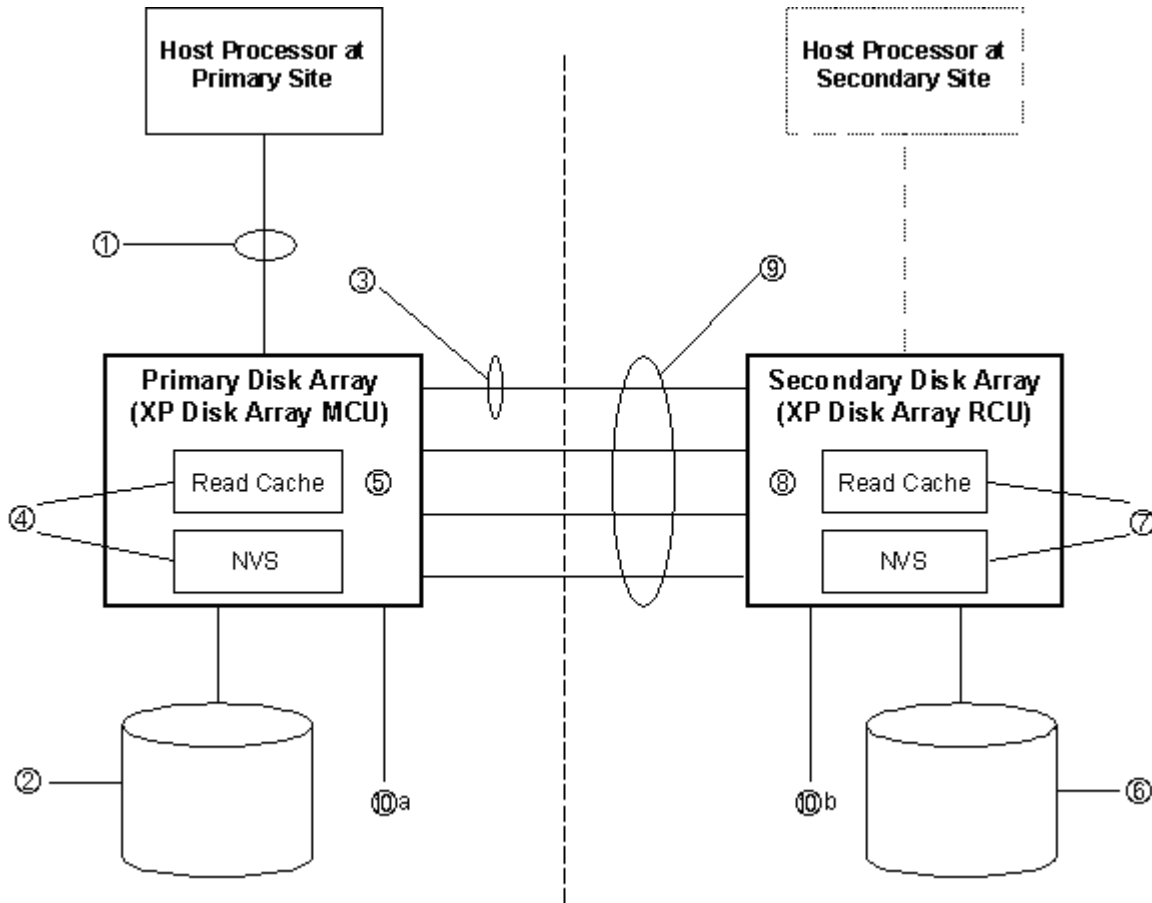


Figure 71 Failure conditions (described in [Table 38](#))

Table 38 XP128/XP1024/XP12000 response characteristics to failure conditions

Failure Condition	TC390 Pairs Suspended?	Expected Messages	FREEZE Function
Failure of all channel interfaces on the MCU	No	No IEA480, IEA491, or IEA494 messages are displayed.	Not activated

Table 38 XP128/XP1024/XP12000 response characteristics to failure conditions (continued)

Failure Condition	TC390 Pairs Suspended?	Expected Messages	FREEZE Function
j Failure of a disk on the MCU			
a. Failure of one physical device in a parity group	No	<ol style="list-style-type: none"> 1. IEA480 message (SIM for physical device blocked or port of physical device blocked) is displayed when the next I/O is issued to any logical volume in the parity group. 2. No IEA491 or IEA494 messages are displayed. 	Not activated
b. Failure of two physical devices in a parity group	No	<ol style="list-style-type: none"> 1. IEA480 message (SIM for LDEV blocked) is displayed when the next I/O is issued to any logical volume in the parity group. 2. No IEA491 or IEA494 messages are displayed. 	Not activated
– Failure of a link between the MCU and RCU	No	<ol style="list-style-type: none"> 1. IEA480 message (SIM for TC390 path blocked) is reported when the next I/O to any device in this MCU is issued. 2. No IEA491 or IEA494 messages are displayed. 	Not activated
D Failure of NVS on the MCU; Failure of MCU read cache			
a. One side of MCU cache blocked due to failure	No ¹	<ol style="list-style-type: none"> 1. IEA480 (SIM for cache blocked) is reported when the next I/O to any device in this MCU is issued. 2. No IEA491 or IEA494 messages are displayed. 	Not activated
b. One side of MCU cache blocked due to maintenance	No ¹	No IEA480, IEA491, or IEA494 messages are displayed.	Not activated
c. One side of MCU cache blocked by SET CACHE OFF	No ¹	No IEA480, IEA491, or IEA494 messages are displayed.	Not activated
f Both sides of MCU cache blocked due to failure	No	<p>No IEA480, IEA491, or IEA494 messages are displayed.</p> <p>The MCU returns CC=3 for all I/Os.</p>	Not activated

Table 38 XP128/XP1024/XP12000 response characteristics to failure conditions (continued)

Failure Condition	TC390 Pairs Suspended?	Expected Messages	FREEZE Function
Ý Failure of a disk on the RCU			
a. Failure of one physical device in a parity group	No	<ol style="list-style-type: none"> 1. The RCU reports IEA480 message (SIM for physical device blocked or port of physical device blocked) to either the MCU or the host processor (whichever issues the next I/O first) when the next I/O is issued to any logical volume in the parity group. If MCU receives the SIM, it passes the SIM to the attached host processor, and the IEA480 message is reported when the next I/O to this MCU is issued to any main (primary) volume paired with the logical volume in the parity group. 2. No IEA491 or IEA494 messages are displayed. 	Not activated
b. Failure of two physical devices in a parity group	Yes	<ol style="list-style-type: none"> 1. The RCU reports IEA480 message (SIM for LDEV blocked) to either the MCU or the host processor (whichever issues the next I/O first) when the next I/O is issued to any logical volume in the parity group. If MCU receives the SIM, it passes the SIM to the attached host processor, and the IEA480 message is reported when the next I/O to this MCU is issued to any main volume paired with the logical volume in the parity group. 2. One (or more) IEA494 messages showing EXTENDED LONG BUSY are displayed. 3. One (or more) IEA491 and IEA494 messages showing PAIR SUSPENDED are displayed. 	Activated if the FREEZE option is enabled for the affected LCU pairs.
ý Failure of NVS on the RCU; Failure of RCU read cache			
a. One side of RCU cache blocked due to failure	No	<ol style="list-style-type: none"> 1. The RCU reports IEA480 message (SIM for cache blocked) to either the MCU or the host processor (whichever issues the next I/O first). If MCU receives the SIM, it passes the SIM to the attached host processor. Therefore, IEA480 is reported when the next I/O to any device in this MCU issued. 2. No IEA491 or IEA494 messages are displayed. 	Not activated
b. One side of RCU cache blocked due to maintenance	No	No IEA480, IEA491, or IEA494 messages are displayed.	Not activated

Table 38 XP128/XP1024/XP12000 response characteristics to failure conditions (continued)

Failure Condition	TC390 Pairs Suspended?	Expected Messages	FREEZE Function
c. One side of RCU cache blocked by SET CACHE OFF	No	No IEA480, IEA491, or IEA494 messages are displayed.	Not activated
« Both sides of RCU cache blocked due to failure	Yes	<ol style="list-style-type: none"> 1. No IEA480 (SIM of cache blocked) is displayed. 2. One (or more) IEA494 messages showing EXTENDED LONG BUSY are displayed. 3. One (or more) IEA491 and IEA494 messages showing PAIR SUSPENDED are displayed. 4. If CGROUP FREEZE and RUN are issued, IEA494 messages showing PAIR SUSPENDED are displayed when the MCU accepts CGROUP-RUN. These messages are from the TC390 pairs for which FREEZE option is enabled and from main volumes that did not already report IEA491/IEA494 at (3). 	Activated if the FREEZE option is enabled for the affected LCU pairs.
» Failure of all links between the MCU and RCU	Yes	<ol style="list-style-type: none"> 1. IEA480 (SIM for TC390 path blocked) message is reported when the next I/O to any device in this MCU is issued. 2. One (or more) IEA494 messages showing EXTENDED LONG BUSY are displayed. 3. One (or more) IEA491 and IEA494 messages showing PAIR SUSPENDED are displayed. 	Activated if the FREEZE option is enabled for the affected LCU pairs.
... Power failure			
a. On the MCU	No	No IEA480, IEA491, or IEA494 messages are displayed.	Not activated
b. On the RCU	Yes	<ol style="list-style-type: none"> 1. IEA480 (SIM of TC390 path blocked) message is reported when the next I/O to any device in this MCU is issued. 2. One (or more) IEA494 messages showing EXTENDED LONG BUSY are displayed. 3. One (or more) IEA491 and IEA494 messages showing PAIR SUSPENDED are displayed. 	Activated if the FREEZE option is enabled for the affected LCU pairs.

1. When one side of the MCU cache is blocked, duplex TC390 pairs are not affected, but pending duplex TC390 pairs are suspended. Suspending TC390 pairs with pending duplex status provides additional protection in the unlikely event of a cache failure.

GDPS-TC390-HXRC Matrix

The following table compares IBM 3990-6E GDPS support to XP disk array GDPS support, and also provides a comparison of TC390 and HXRC to PPRC and XRC.



NOTE: The information shown in the following table was current at the time of publication of this document but is expected to change over time. Contact your HP account support representative for the latest GDPS-TC390-HXRC matrix information.

Table 39 GDPS-TC390-HXRC matrix

zSeries and S/390 Feature	IBM 3990-6E	XP128/XP1024/XP12000	XP48/XP512
GDPS			
Planned outage	Supported	Supported	Supported
Unplanned outage through IEA494I	Supported	Supported	Supported
IEA494I Long Busy message	Default time of 120 seconds for FREEZE after IEA494I message is issued.	Default time for FREEZE is 120 seconds, optional user-defined from 0 to 600 seconds after IEA494I message is issued.	Default time for FREEZE is 120 seconds, optional user-defined from 0 to 600 seconds after IEA494I message is issued.
Peer-to-Peer Remote Copy	PPRC	TC390, TC390A	CA
Hardware based	3990-6 to 3990-6	XP128/XP1024/XP12000 to XP128/XP1024/XP12000. XP128/XP1024 is restricted to CPU 0-3 when attached to XP256.	XP128/XP1024/XP12000 to XP128/XP1024/XP12000. XP128/XP1024/XP12000 is restricted to CPU 0-3 when attached to XP256.
disk array-disk array interface	ESCON – maximum of 43 km Communication through channel extenders	ESCON – maximum of 43 km Communication through channel extenders	ESCON – maximum of 43 km Communication through channel extenders
Copy modes supported	Synchronous	Synchronous, asynchronous The default for IBM software commands is synchronous.	Synchronous, semi-synchronous, asynchronous Semi-synchronous can be specified only by Remote Console PC (or SVP). The default for IBM software commands is synchronous.
Dual Copy combination support	Supported	Not Supported. Dual Copy is not supported by disk array.	Not Supported. Dual Copy is not supported by disk array.

Table 39 GDPS-TC390-HXRC matrix (continued)

zSeries and S/390 Feature	IBM 3990-6E	XP128/XP1024/XP12000	XP48/XP512
TSO command Support	Supported	Supported. Some additional options only available through the Command View management station (or SVP).	Supported. Some additional options only available through the Remote Console PC (or SVP).
ICKDSF command support	Supported	Supported. Some additional options only available through the Command View management station (or SVP).	Supported. Some additional options only available through the Remote Console PC (or SVP).
P/DAS support	Supported	Supported	Supported
Maximum pairs	64	8,192	4,096
Maximum paths between disk arrays	4	8 per logical control unit	8 per logical control unit
Number of copy operations on initial copy	4	1 to 4, default is 4 per LCU. Requires Command View management station (or SVP) to change default.	1 to 4, default is 4 per LCU. Requires Remote Console PC (or SVP) to change default.
Dedicated interface between disk arrays	No	Requires main disk array port to be set to Target by Command View management station (or SVP) or automatically in response to establish and delete path commands.	Requires main disk array port to be set to LCP or Target by Remote Console PC (or SVP) or automatically in response to establish and delete path commands.
PACE parameter initial copy option	1-255, default is 15 (setting of 1 copies a maximum of 3 tracks at a time, 2-255 copies a maximum of 15 tracks at a time)	3 or 15, default = 15 tracks	3 or 15, default = 15 tracks
CRITICAL pair error options (Fence Level parameter)	Yes No – Default	R-VOL Data Never – Default R-VOL Status	R-VOL Data Never – Default R-VOL Status
CGROUP	FREEZE/RUN by logical controller SSID pair	FREEZE/RUN by logical controller SSID pair, or optionally by entire disk array using mode 64.	FREEZE/RUN by logical controller SSID pair, or optionally by entire disk array using mode 64.

Table 39 GDPS-TC390-HXRC matrix (continued)

zSeries and S/390 Feature	IBM 3990-6E	XP128/XP1024/XP12000	XP48/XP512
CQUERY	Supported	Supported.	Supported. When the connected control unit is an XP48/XP512, Mode 49 must be ON to report on all the 256 LDEVs in each logical control unit.
TC-Unique Features (specified through the Command View management station or SVP)			
RCU Options			
Minimum paths	Not supported	Default = 1. If the minimum number of MCU-RCU active paths falls below this value, all pairs will be suspended based on the Fence Level option in effect.	Default = 1. If the minimum number of MCU-RCU active paths falls below this value, all pairs will be suspended based on the Fence Level option in effect.
PPRC support by host	Host must support PPRC	Default = YES - PPRC supported, optional capability to allow host support for non PPRC capable operating systems.	Default = YES - PPRC supported, optional capability to allow host support for non PPRC capable operating systems.
RCU-to-MCU SIM reporting	Not supported per the IBM document, <i>Planning for IBM Remote Copy</i> (SG24-2594-009 p.184)	To any host or only to RCU host	To any host or only to RCU host
RCU to MCU service SIM reporting	Not supported per the IBM document, <i>Planning for IBM Remote Copy</i> (SG24-2594-009 p.184)	Default = Not report; Table 40 on page 191 and Table 41 on page 191 list remote copy service SIMs. Designed for non-MVS operating systems that do not support SIM reporting.	Default = Not report; Table 40 on page 191 and Table 41 on page 191 list remote-copy service SIMs. Designed for non-MVS operating systems that do not support SIM reporting.
Pair Options			
Cache fast write data	Not supported	Optional to R-VOL, default = M-VOL	Optional to R-VOL, default = M-VOL
Extended Remote Copy	XRC	HXRC*	HXRC
SMS 1.3 - SDM ver. 1	Not supported	Not supported	Not supported
SMS 1.3 + PTFs - SDM ver. 2	Supported	Supported	Supported
SMS 1.4 – SDM ver. 2	Supported	Supported	Supported

Table 39 GDPS-TC390-HXRC matrix (continued)

zSeries and S/390 Feature	IBM 3990-6E	XP128/XP1024/XP12000	XP48/XP512
SMS 1.4+ PTFs – SDM ver. 2	Supported	Supported	Supported
SMS 1.5 – SDM ver. 2	Supported	Not supported, in QA test	Not supported, in QA test
Max. sessions	4 per disk array	4 per CU image, 128 total	4 per CU image, 64 total
Max. volumes	256 per disk array	256 per CU image, 8,192 total	256 per CU image, 4,096 total
Utility volumes with Multi Reader Support #OW30183	Multiple supported	Multiple supported	Multiple supported
SIM/error messages	Per the IBM document	Per the IBM document	Per the IBM document
Primary disk array interface	Parallel or ESCON	ESCON only	ESCON only
Secondary disk array interface	Parallel or ESCON	Parallel or ESCON	Parallel or ESCON
Channel extender support	Yes	Contact your HP account support representative for the latest information.	Contact your HP account support representative for the latest information.
Maximum sidefile size	50%	50% available cache	50% available cache
Sidefile puncture %	60%	60%. Retries issued at 40% utilization, host interface blocked at 50% utilization.	60%. Retries issued at 40% utilization, host interface blocked at 50% utilization.



NOTE: For more information on HXRC device blocking and load balancing control, refer to “[HXRC Device Blocking and Load Balancing](#)” on page 225.

Pinned Track Recovery for TrueCopy Volumes

If a pinned track occurs on a TC390 M-VOL or R-VOL, the MCU will suspend the pair (SIM reference code = D41x, D42x, DB1x, DB2x). Use the following procedure to ensure full data integrity of the volume pair while recovering the pinned track:

1. Connect to the MCU of the TCz pair that contains the volume with the pinned track, and select the correct CU image.
2. Delete the TCz pair that contains the volume with the pinned track.



NOTE: If you delete the TCz pair containing the volume with the pinned track, delete only the pair containing the volume with the pinned track. To delete only the TCz Asynchronous volume pair containing the volume with the pinned track, select **Volume** for **Asynchronous Parameters** and **Delete Range**.

3. If the volume is offline (for example, R-VOL has pinned track), vary the volume online.
4. Perform your usual procedure for recovering data from a pinned track. Refer to the pinned track recovery procedures for your operating system. Contact your HP account support representative to inform them of the pinned track.
5. If the volume was previously offline (for example, R-VOL), make sure to vary the volume offline again.
6. Restart the volume pair using the Add Pair window, making sure to use the Entire initial copy option.



NOTE: Be sure to specify the volume pair for which the pinned track recovery operation was performed.

SIM Reporting

The XP128/XP1024/XP12000 reports a service information message (SIM) to the host when it is necessary to notify the user of a possible service requirement for the disk array. The SIMs are classified according to severity for reporting and logging purposes: service, moderate, serious, or acute. The SVP reports all SIMs related to TC390 operations and all SIMs are stored on the SVP for use by HP personnel. The SIMs reported to the zSeries and S/390 host are logged in the SYS1.LOGREC dataset of the host operating system. Each time a SIM is generated, the amber **Message** LED on the XP128/XP1024/XP12000 control window (under the **Ready** and **Alarm** LEDs) turns on as an additional alert for the user. The XP128/XP1024/XP12000 also reports SIMs to the Command View management station to provide an additional source of notification for the user.

During TC390 operations, the MCU and RCU will generate a service SIM each time the pair status of the M-VOL or R-VOL changes for any reason, including normal status transitions (for example, *pending duplex* to *duplex*). For TC390A transition states (*suspending* and *deleting*), a SIM is generated when the status changes to the transition state and again when the transition is complete. SIMs generated by the MCU will include the M-VOL device ID (byte 13) and SIMs generated by the RCU will include the R-VOL device ID (byte 13). Use the RCU Option window (see "[Registering an RCU \(Add RCU\)](#)" on page 93) to configure each MCU to report or not report service-level SIMs to the attached host(s).

The following figure shows a typical 32-byte SIM from the XP128/XP1024/XP12000. SIMs are displayed on the host console by reference code (RC) and severity. The six-digit RC (composed of bytes 22, 23, and 13) identifies the possible error and determines the severity. The SIM type (byte 28) indicates the component that experienced the error. When byte 22 = 21, the SIM is a control unit SIM. When byte 22 = Dx, the SIM is a device SIM. When byte 22 = (D5-D7, DB), the specified pair is TC390A. When

byte 22 = (D8 - DC), the pair is TC390 Synchronous. The SIM reference codes DB6x, DB7x, and DB8x indicate a TC390A pair suspended by the RCU.

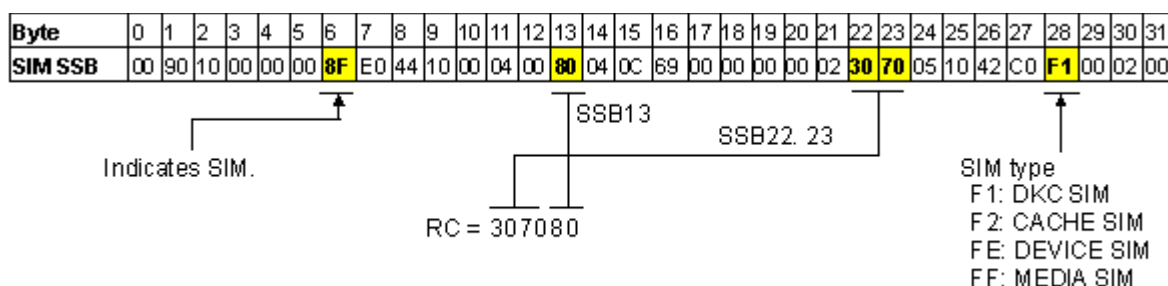


Figure 72 Typical XP128/XP1024/XP12000 SIM showing reference code and SIM type

The following table lists and describes the control unit SIMs (byte 28 = F1) related to TC390 operations. [Table 41 on page 191](#) lists and describes the device SIMs (byte 28 = FE) related to TC390 operations. Both of these tables also specify the severity, host reporting, and SVP log file for each SIM.



NOTE: The SIM information for the XP128/XP1024/XP12000 changes as new features and functions are added and supported. Contact your HP account support representative or HP technical support for the latest SIM information for the XP128/XP1024/XP12000.

Table 40 TrueCopy control unit SIMs

Ref. Code		Severity	Description	Reported to Host	SVP Log File
22	23				
21	80	Moderate	The logical path(s) on the remote copy connection(s) was logically blocked due to an error condition.	Yes Repeat	SIM Log
21	81	Service	The logical path on the remote copy connection has recovered from the blocked condition.	Yes* Once	SSB Log
21	82	Moderate	MCU received notification of an error detection for communication line from the extender.	Yes Repeat	SIM Log

This SIM is not reported to the host system when the **Service SIM=Not Report** RCU option is selected.

Table 41 TrueCopy device SIMs

Ref. Code		Severity	Description	Reported to Host	Generated by	Log File
22	23					
D0	0x	Service	TC390 started the initial copy for this volume, or was out of sync for this volume.	Yes ¹ Once	MCU	SSB Log
D0 D8	1x	Service	TC390 completed the initial copy for this volume.	Yes ¹ Once	MCU	SSB Log
D0	2x	Service	TC390 for this volume was deleted as requested by the Command View management station, SVP, or host.	Yes ¹ Once	MCU	SSB Log

Table 41 TrueCopy device SIMs (continued)

Ref. Code		Severity	Description	Reported to Host	Generated by	Log File
22	23					
D0	3x	Service	The MCU changed the volume pair status as requested by the Command View management station, SVP, or host.	Yes ¹ Once	MCU	SSB Log
D1	sx	Service	<p>Status of the R-VOL has changed as requested by the MCU. The third digit of the reference code "s" indicates change of states as follows:</p> <p>0: from simplex to pending</p> <p>1: from simplex to duplex</p> <p>2: from pending to duplex</p> <p>3: from pending to suspended</p> <p>4: from duplex to suspended</p> <p>5: from duplex to simplex</p> <p>6: from pending to simplex</p> <p>7: from suspended to simplex</p> <p>8: from suspended to pending.</p>	Yes ¹ Once	RCU	SSB Log
D2	0x	Service	The RCU changed the R-VOL status to <i>suspended</i> as requested by Command View management station, SVP, or host.	No	RCU	SSB Log
D2	1x	Service	The R-VOL status changed from <i>suspended</i> to <i>simplex</i> as requested by Command View management station, SVP, or host.	No	RCU	SSB Log
D2	2x	Service	The R-VOL status has changed from <i>duplex</i> to <i>simplex</i> .	No	RCU	SSB Log
D2	3x	Service	The TC390 R-VOL status has changed from <i>pending duplex</i> to <i>simplex</i> .	No	RCU	SSB Log
D4	0x	Serious	TC390 for this volume was suspended due to a failure on the remote copy connection.	Yes ² Repeat	MCU	SIM Log
D4	1x	Serious	TC390 for this volume was suspended due to a failure on the M-VOL or remote copy.	Yes ² Repeat	MCU	SIM Log
D4	2x	Serious	TC390 for this volume was suspended due to a failure on the R-VOL.	Yes ² Repeat	MCU	SIM Log
D4	3x	Serious	TC390 for this volume was suspended because DFW to the R-VOL was blocked.	Yes ² Repeat	MCU	SIM Log

Table 41 TrueCopy device SIMs (continued)

Ref. Code		Severity	Description	Reported to Host	Generated by	Log File
22	23					
D4	4x	Serious	TC390 for this volume was suspended due to an internal error condition detected by the RCU.	Yes ² Repeat	MCU	SIM Log
D4	5x	Serious	TC390 for this volume was suspended because the operator deleted the volume pair from the RCU.	Yes ² Repeat	MCU	SIM Log
D4	Cx	Service	The MCU detected a service-level SIM at the RCU.	Yes ¹ Once	RCU	SSB Log
D4	Dx	Moderate	The MCU detected a moderate-level SIM at the RCU.	Yes ¹ Repeat	RCU	SIM Log
D4	Ex	Serious	The MCU detected an acute- or serious-level SIM at the RCU.	Yes ¹ Repeat	RCU	SIM Log
D4	Fx	Serious	The status of the M-VOL is not consistent with the status of the R-VOL.	Yes ² Repeat	MCU	SIM Log
D5	0x	Service	TC390 started the initial copy for this volume, or was out of sync for this volume.	Yes ¹ Once	MCU	SSB Log
D5	1x	Service	TC390 completed the initial copy for this volume.	Yes ¹ Once	MCU	SSB Log
D5	2x	Service	The volume pair accepted Delete Pair operation.	Yes ¹ Once	MCU	SSB Log
D5	3x	Service	The volume pair accepted Suspend Pair operation.	Yes ¹ Once	MCU	SSB Log
D5	4x	Service	Delete Pair operation for this volume pair has completed.	Yes ¹ Once	MCU	SSB Log
D5	5x	Service	Suspend Pair operation for this volume pair has completed	Yes ¹ Once	MCU	SSB Log

Table 41 TrueCopy device SIMs (continued)

Ref. Code		Severity	Description	Reported to Host	Generated by	Log File
22	23					
D6	sx	Service	<p>The R-VOL status has changed as requested by the MCU. The third digit of the reference code "s" indicates change of states as follows:</p> <p>0: from simplex to pending</p> <p>1: from simplex to duplex</p> <p>2: from pending to duplex</p> <p>3: from pending to suspended</p> <p>4: from duplex to suspended</p> <p>5: from duplex to simplex</p> <p>6: from pending to simplex</p> <p>7: from suspended to simplex</p> <p>8: from suspended to pending</p>	Yes ¹ Once	RCU	SSB Log
D7	sx	Service	<p>The R-VOL has accepted/completed state change as requested by operation. The third digit of the reference code "s" indicates the events as follows:</p> <p>0: Accepted Suspend Pair operation.</p> <p>1: Accepted Delete Pair operation. R-VOL is suspended.</p> <p>2: Accepted Delete Pair operation. R-VOL is duplex.</p> <p>3: Accepted Delete Pair operation. R-VOL is pending.</p> <p>4: Completed Suspend Pair operation.</p> <p>5: Completed Delete Pair operation.</p>	No	RCU	SSB Log
DB	0x	Serious	The volume pair was suspended due to a failure on the remote copy connections.	Yes ² Repeat	MCU	SIM log
DB	1x	Serious	The volume pair was suspended due to a failure on the M-VOL or remote copy.	Yes ² Repeat	MCU	SIM log
DB	2x	Serious	The volume pair was suspended due to a failure on the R-VOL.	Yes ² Repeat	MCU	SIM log
DB	3x	Serious	The volume pair was suspended because DFW to the R-VOL was blocked.	Yes ² Repeat	MCU	SIM log

Table 41 TrueCopy device SIMs (continued)

Ref. Code		Severity	Description	Reported to Host	Generated by	Log File
22	23					
DB	4x	Serious	The M-VOL has changed to suspended state due to an internal error condition detected by the RCU.	Yes ² Repeat	MCU	SIM log
DB	5x	Serious	The M-VOL has changed to suspended state because the operator deleted the volume pair from the RCU.	Yes ² Repeat	MCU	SIM log
DB	6x	Serious	The RCU has suspended all R-VOLs in the consistency group due to time out failure defined by the maximum copy delay time.	Yes ² Repeat	RCU	SIM log
DB	7x	Serious	The RCU has suspended all R-VOLs in the consistency group due to the internal logic error.	Yes ² Repeat	RCU	SIM log
DB	8x	Service	The R-VOL was suspended due to MCU power-off event.	Yes ¹ Once	RCU	SSB Log
DB	Fx	Serious	The status of the M-VOL is not consistent with the status of the R-VOL.	Yes ² Repeat	MCU	SIM log

1. These SIMs are reported to the host only if the Service SIM=Report and PPRC Support=No RCU options are both selected.

2. These SIMs are reported to the host system only if the PPRC Support=No RCU option is selected.

TrueCopy Scripting

Overview of Scripting

An added benefit of the TC390 feature is its support for scripting operations. This capability provides the user with additional flexibility in managing their TC390 environment. A TC390 script file contains a list of macros (commands) that describes a series of TC390 pair operations. The TC390 scripting macros are defined in a text file, and Command View reads the text file and executes the specified TC390 pair operations.



NOTE: This section assumes that the user is familiar with batch files and does not provide instructions for writing or editing batch files. The macro commands and parameters listed in this section are the only commands recognized by the TC390 scripting function.



CAUTION: The user is responsible for testing the TC390 scripting function before running any TC390 scripts. If a TC390 script is run without prior testing and the script ends abnormally, data loss could occur. Before testing a TC390 script, back up the data and vary the volumes offline. If the volumes must remain online, back up the data and confirm that the target volume pair defined in the TC390 script is correct. The results of a TC390 script can be confirmed by checking the latest TC390 pair status update (**Last Updated** box on TC390 Pair Status window).

Table 42 on page 196 lists the TC390 pair macro commands. Table 43 on page 197 lists the internal macro commands for TC390 scripting. The following TC390 operations cannot be performed using TC390 scripting:

- Configure serial/fibre ports ("[Configuring the Host Interface Ports](#)" on page 90).
- Monitor remote copy activity ("[Usage Monitor Window](#)" on page 84).
- Clear remote copy SIMs ("[Other Operations](#)" on page 118).
- Add/delete RCU ("[Registering an RCU \(Add RCU\)](#)" on page 93 and "[Deleting an RCU \(Delete RCU\)](#)" on page 101).
- Change RCU options ("[Modifying RCU Options \(Change RCU Option\)](#)" on page 98).
- Add/delete path/SSID ("[Adding and Deleting Logical Paths for an RCU \(Add Path and Delete Path\)](#)" on page 101 and "[Adding and Deleting SSIDs for an RCU \(Add SSID and Delete SSID\)](#)" on page 104).
- View RCU status ("[Viewing RCU Status \(RCU Status\)](#)" on page 91).
- Change async options ("[Asynchronous Copy Option](#)" on page 112).
- Add/delete group ("[Adding Consistency Groups \(Add CT Group\)](#)" on page 109 and "[Deleting Consistency Groups \(Delete CT Group\)](#)" on page 112).
- Change group options ("[Modifying Consistency Group Options \(CT Group Option\)](#)" on page 110).
- View group status ("[Viewing Consistency Group Status \(CT Group Status\)](#)" on page 107).



NOTE: The scripting command names did not change between CA and TC390. Your existing CA scripting files can be used for TC390 operations.

Table 42 Functional macro commands for TrueCopy scripting

TC390 Scripting Macro	Description
CreateHrcPair	Registers a TC390 pair or pairs. (StartHrcPair is used to start the initial copy operation.)
SuspendHrcPair	Suspends a TC390 pair or pairs.
DeleteHrcPair	Deletes a TC390 pair or TC390 pairs.
ResumeHrcPair	Resumes a TC390 pair or TC390 pairs. Use with StartHrcPair.
ChangeHrcOption	Changes the pair options for a TC390 pair or TC390 pairs.
StartHrcPair	Starts remote copy operations for the new pairs and/or resumed pairs specified in the preceding scripting commands.
GetHrcStatus	Displays the status of a TC390 pair or TC390 pairs.
SelectHrcDevice	Searches TC390 paired devices.

Table 43 Internal macro commands for TrueCopy scripting

Type	Macro	Description
For lists	SetList	Set (define) a list of items.
	AddList	Add items to a list.
For non-lists	Start	Declares the beginning of a script.
	End	Declares the end of a script.
	Delay	Suspends script execution for the specified length of time.
	If	Executes a script conditionally.
	EndIf	Terminates a script conditionally.
	MakeString	Makes strings; converts numeric value to character string.

Syntax for Scripting

Syntax Overview

A TC390 script file can be written using any text editor (for example, WordPad or Notepad). A script file consists of an unlimited number of statements that consist of macros (commands), work variables, and comments (see ["Operation Macro Commands"](#) on page 199 and ["Internal Macro Commands"](#) on page 209). The first executable statement in a TC390 script file must be the Start macro and the last statement must be the End macro. Each line in a TC390 script file cannot exceed 320 bytes. A leading blank is ignored and a leading tab character (0x09) is converted to a space (0x20). A tab character (0x09) within a string is not converted to a space.

Each script file should contain all five script statements (see [Table 44](#) on page 197 and [Table 45](#) on page 198):

- A comment statement, including a short preface for the script: purpose, author, usage, description, operation, creation date, update date, and any reminder notes to the author. The comment statement is a non-execution statement. A comment statement begins with `/**` and contains text (any character string) without any commands. Do not use the `/**` symbol anywhere else in a script file, only at the beginning of a comment statement.
- A macro statement (see ["Operation Macro Commands"](#) on page 199 and ["Internal Macro Commands"](#) on page 209). The macro statement is an execution statement. Only one macro instruction can be set per line and a macro can span more than one line.
- A work variable statement (see ["Work Variables"](#) on page 212). The work variable statement is also an execution statement. Only one work variable statement can be set per line and a work variable statement cannot span more than one line.
- A blank statement (see [Table 44](#)). The blank statement is a non-execution statement.
- An empty statement (see [Table 44](#)). The empty statement is a non-execution statement.

Table 44 Syntax description

Statement Name	Description
Blank statement	Space or Tab with a return
Comment statement	One line beginning with <code>/**</code>

Table 44 Syntax description (continued)

Statement Name	Description
Empty statement	Return only
Execution statement	Work variable statement (non-list type work variable = constant)
Macro statement	Macro name [parameter list] Refer to " Operation Macro Commands " on page 199 and " Internal Macro Commands " on page 209 for macro information.

Table 45 Script components

Component Name	Description
Macro name	Either an internal macro or a functional macro.
Parameter list	Parameter identification name (defined in each macro format) = non-list type expression.
Expression	List, constant, and work variable.
List	In a list description, a constant is enclosed in braces "{}". A comma "," is inserted between constants. Example: {1, 2, 3, 4}, or {"ABC", "qtw"}. Lists and work variables cannot be described in a list.
Constant	String or a numeric value.
String	The string covers the following lists. Enclose a list with a double-quotation mark (""). Letters (uppercase and lowercase), numbers, symbols. <ul style="list-style-type: none"> Numeric list: List that consists of (0, 1, 2, 3, 4, 5, 6, 7, 8, 9) Hexadecimal number list: List that begins with 0x/0X of (A, B, C, D, E, F, a, b, c, d, e, f)
Reserved variables	Reserved variables can be referenced in a script only. Setting a value is not possible.

Script File Requirements

The following table lists the requirements for the components of a script file.

Table 46 Script file requirements

Item	Requirement
Maximum length of one line of a script	320 bytes
Maximum number of items of one list type identification name	1,024
Maximum length of one item of a list type work variable string	16 bytes
Maximum length of one item of a non-list type string	150 bytes
Maximum number of items of macro trace storage	1,000
Maximum number of items of error trace	1,000

Script Symbols

Symbols can be used in a script to enhance or limit the power of each script command. The following table lists and describes the symbols that can be used in a script.

Table 47 Script symbols

Symbol ¹	Use
Quotation mark	Used to define the character constant by enclosing with it quotation marks.
Space	Used to delimit the before and after phrases.
Comma	Used to delimit the before and after phrases. This symbol must be placed by following each macro description rule.
Brace	Used to describe a list.
Parenthesis	Only used to describe a condition in the If statement.
Exclamation mark	Used as an operator in the If statement by placing the equal sign next to it. This symbol is not useful when used alone.
Unequal sign	Used as an operator in the If statement when used alone. When the equal sign follows, nothing changes.
Equal sign	Used as a substitute sign when used alone. When the equal sign follows, it becomes an operator in the If statement.

1. The before and after phrases are split by the above symbols. Each symbol is recognized as a single word.

Operation Macro Commands

The functional macros are the script equivalents of the following TC390 pair operations:

- Create pairs (see page 199)
- Delete pairs (see page 202)
- Suspend pairs (see page 203)
- Resume pairs (see page 204)
- Change pair options (see page 205)
- Start pairs (see page 206)
- Get pair status (see page 206)
- Select pair devices (see page 207)

Create Pairs

Use the CreateHrcPair command to establish new TC390 volume pairs.



NOTE: The CreateHrcPair command only creates the pair. You must run the StartHrcPair command after establishing the pair to start the remote copy process.

The CreateHrcPair parameters are:

- M-VOL device list (numeric): $C \times 0x100 + VV$, where $C=CU\#$, $VV=vol\#$ within CU.
- Serial number list (string): RCU serial number (serial number is five digits decimal 0-9). Do not specify more than 12 RCUs.
- SSID number list (numeric): RCU SSID (four digits hexadecimal 0-F).
- R-VOL device list (numeric): $C \times 0x100 + VV$, where $C=CU\#$, $VV=vol\#$ within CU.
- Initial copy pace list (string): "CP_MIDDLE" (0x01) = 3 tracks; "CP_FAST" (0x02) = 15 tracks; default = CP_FAST.
- Initial copy mode list (string): "E" (0x00) = entire; "N" (0x01) = none; default = E.
- Sync level list (string): "S0" or "Synchronous0" (0x00) = sync, "S2" or "Synchronous2" (0x02) = async; default = S0. S0 and S2 cannot be specified at the same time.
- CT group list (numeric): consistency group number (0x00 - 0x7F). For async pairs you must specify this parameter. For sync pairs you must omit this parameter.
- Priority list (numeric): priority of initial copy operation (1-256); default = 32.
- Fence level list (string): "N" or "Never" = (0x00); "S" or "Status" = (0x02); "D" or "Data" = (0x01); default = "Never". For async pairs you must either specify N (never) or omit this parameter.
- CFW flag list (numeric): 0 = copy CFW data to R-VOL; 1 = only M-VOL; default = 1.
- DFW flag list (numeric): 0 = DFW not required; 1 = DFW required; default = 0. Must be omitted for async pairs.
- Error level list (string): "G" (0x00) = group; "V" (0x01) = volume; default = G. For sync pairs you must omit this parameter.
- Time-Saving Mode flag: "Yes" = The **Use Time-Saving Mode** option is enabled; "No" = The **Use Time-Saving Mode** option is disabled; default = "Yes". This parameter is a non-list type and only one value can be specified.
- Differential management measurement flag list (string): The differential between the volumes is managed in Cylinder ("Cylinder" or "C") or in Track ("Track" or "T"). When "Auto" or "A" is specified, the disk array selects the differential management measurement (cylinder or track) automatically. The default is Auto. If the disk array does not support the "Auto" option, "Track" is specified as the default.

The following CreateHrcPair command output shows an example of the pair macro commands needed to create the specified pairs with the parameters listed in the following table.



CAUTION: When using the CreateHrcPair command to create more than one pair, make sure to keep each line within the maximum line length (320 bytes). For script command restrictions and parameters, refer to “[Script File Requirements](#)” on page 198.

Table 48 Example of CreateHrcPair parameters

Parameter	Value	Parameter	Value
M-VOL	_ilDevA	CT group	[omit – N/A]
Serial number (RCU)	_slWorkA	Priority	_ilWorkA
SSID (RCU)	11	Fence level	Never
R-VOL	_ilDevB	CFW flag	0
Initial copy pace	_slWorkB	DFW flag	1
Initial copy mode	E	Error level	[omit – N/A]
Sync level	S0, S0, S0	Time-Saving Mode	[omit – default]

Example: CreateHrcPair Command

```
Start $Script="HRC",$Svr="CU-Name"

// $Dev
SetList $D =_ilDevA, $S = {0x0100,0x0101,0x0102,0x0103,0x0104,0x0105,0x0106,0x0107}
AddList $D =_ilDevA, $S = {0x0108,0x0109,0x010A,0x010B,0x010C,0x010D,0x010E,0x010F}
// $Rdev
SetList $D =_ilDevB, $S = {0x1F00,0x1F01,0x1F02,0x1F03,0x1F04,0x1F05,0x1F06,0x1F07}
AddList $D =_ilDevB, $S = {0x1F08,0x1F09,0x1F0A,0x1F0B,0x1F0C,0x1F0D,0x1F0E,0x1F0F}
// $Priority
SetList $D =_ilWorkA, $S = {1,2,3,4,16.32}
// $Fence
SetList $D =_slWorkB, $S = {"D","S","S","N"}

CreateHrcPair $Dev = _ilDevA, $RcuSn = "12345", $RcuSsid = 4, $Rdev = _ilDevB, $Priority =
_ilWorkA, $Fence = _slWorkB
StartHrcPair

// $Dev
SetList $D =_ilDevA, $S = {0x0B80,0x0B81,0x0B82}
AddList $D =_ilDevA, $S = {0x0C2A,0x0C2B,0x0C2C}
// $Rdev
SetList $D =_ilDevB, $S = {0x1045,0x1047,0x105E}
AddList $D =_ilDevB, $S = {0x1130,0x1139,0x113D}
// $RcuSn
SetList $D =_slWorkD, $S = {"32072","32072","32072","28439","28439","28439"}
// $RcuSsid
SetList $D =_ilWorkC, $S = {33,33,33,0xA74C,0xA74C,0xA74C}
// $CTG
SetList $D =_ilWorkB, $S = {0x7F,0x7F,0x7F,10,10,10}

CreateHrcPair $Dev = _ilDevA, $RcuSn = _slWorkD, $RcuSsid = _ilWorkC, $Rdev = _ilDevB, $Sync
= "S2", $CTG = _ilWorkB
StartHrcPair

End
```

Delete Pairs

The DeleteHrcPair command deletes TC390 pairs. The DeleteHrcPair parameters include:

- Device list (numeric): C x 0x100 + VV, where C=CU#, VV=vol# within the CU.
- Delete mode list (numeric): 0 (0x00) = normal, 1 (0x01) = delete by force; default = 0. You must specify 0 (normal) when deleting two or more async pairs.
- Delete range list (string): "G" or "Group" = group; "V" or "Volume" = volume; "C" or "C/T" = consistency time. For sync pairs you must omit this parameter.
 - When two or more volumes are specified, the default = V. If you want to delete two or more specific async pairs, you can specify V or omit this parameter.
 - When one volume is specified, the default = G under these conditions:
 - Volume is an M-VOL and delete mode = 0 (normal) (any pair status); or
 - Volume is an R-VOL, delete mode = 0, and pair status = suspending or deleting.

If you want to delete an entire group by force (delete mode = 1), you must specify G.

- When one volume is specified, the default = C/T under these conditions:

Volume is an R-VOL, delete mode = 0, and pair status is not suspending or deleting.

- Time-Saving Mode flag: "Yes" = The **Use Time-Saving Mode** option is enabled; "No" = The **Use Time-Saving Mode** option is disabled; default = "Yes". This parameter is a non-list type and only one value can be specified.

The following provides an example of the pair macro commands needed to delete the specified pair with delete mode = normal.

Example: DeleteHrcPair Command

```
Start $Script="HRC", $Svr="CU-Name"

// $Dev
SetList $D =_ilDevA, $S = {0x0800,0x0901,0x0A02}
AddList $D =_ilDevA, $S = {0x0B03,0x0C04,0x0D05,0x0E06}

// $DelMode
SetList $D = _ilWorkA, $S = {0, 1, 0}

DeleteHrcPair $Dev = _ilDevA, $DelMode = _ilWorkA

DeleteHrcPair $Dev = 0x124C, $DelRange = "Group"

End
```

Suspend Pairs

The SuspendHrcPair command suspends TC390 pairs. The SuspendHrcPair parameters include:

- Device list (numeric): C x 0x100 + VV, where C=CU#, VV=vol# within the CU.
- Suspend mode list (string): "M" or "M-Vol" (0x00) = M-VOL failure, "R" or "R-Vol" (0x01) = R-VOL; default = R-VOL. You must specify R or omit this parameter when suspending async pairs.
- Flag list (numeric): suspend report flag: 0 = reports; 1 = no reports; default = 1.
- Suspend range list (string): "G" or "Group" (0x04) = group; "V" or "Volume" (0x00) = volume. For sync pairs you must omit this parameter.
 - When one volume is specified, the default = G. If you want to suspend only one async pair, you must specify V.
 - When two or more volumes are specified, the default = V. When two or more volumes are specified, you must either specify V or omit this parameter.
- Pending data flag list (string): "D" or "Drain" (0x00) = drain; "P" or "Purge" (0x08) = purge; default = D. For sync pairs you must omit this parameter.
- Time-Saving Mode flag: "Yes" = The **Use Time-Saving Mode** option is enabled; "No" = The **Use Time-Saving Mode** option is disabled; default = "Yes". This parameter is a non-list type and only one value can be specified.

The following provides an example of the pair macro commands needed to suspend the specified pair with suspend mode = R-VOL and the default flag of no reports.

Example: SuspendHrcPair Command

```
Start $Script="HRC",$Svr="CU-Name"

// $Dev
SetList $D = _ilDevA, $S = {0x0100,0x0101,0x0102,0x0103}
AddList $D = _ilDevA, $S = {0x0104,0x0105,0x0106,0x0107,0x0108}
// $SusReport
SetList $D = _ilWorkA, $S = {0, 1, 0}
// $SusMode
SetList $D = _slWorkA, $S = {"R-Vol", "M", "R", "M-Vol"}

SuspendHrcPair $Dev = _ilDevA, $SusMode = _slWorkA, $SusReport =
_ilWorkA

// $Dev
SetList $D = _ilDevB, $S = {0x0900,0x0901,0x0902,0x0903}
// $PendData
SetList $D = _slWorkC, $S = {"Drain", "Purge", "P", "D"}

SuspendHrcPair $Dev = _ilDevB, $PendData = _slWorkC, $SusRange =
"Volume"

End
```

Resume Pairs

The ResumeHrcPair command resumes TC390 pairs. The ResumeHrcPair parameters include:

- M-VOL device list (numeric): C x 0x100 + VV, where C=CU#, VV=vol# within CU.
- Priority list (numeric): priority of initial copy operation (numeric 0-256); default = 32.
- Fence level list (string): "N" or "Never" (0x00) = never; "S" or "Status" (0x02) = status; "D" or "Data" (0x01) = data; default = current value. For async pairs you must either specify N (never) or omit this parameter.
- Sync level list (string): "S0" or "Synchronous0" (0x00) = sync, "S2" or "Synchronous2" (0x02) = async; default = current value.
- Error level list (string): "G" or "Group" (0x00) = group; "V" or "Volume" (0x01) = volume; default = current value. For sync pairs you must omit this parameter.
- Resume range list (string): "G" (0x00) = group; "V" (0x01) = volume. For sync pairs you must omit this parameter.
 - When one volume is specified, the default = G. If you want to resume only one async pair, you must specify V.
 - When two or more volumes are specified, the default = V. When two or more volumes are specified, you must either specify V or omit this parameter.
- Time-Saving Mode flag: "Yes" = The **Use Time-Saving Mode** option is enabled; "No" = The **Use Time-Saving Mode** option is disabled; default = "Yes". This parameter is a non-list type and only one value can be specified.

The following provides an example of the pair macro commands needed to resume the specified pair in synchronous mode with fence level = never and priority = 1.



NOTE: After resuming pairs, you must run the StartHrcPair command to begin remote copy activity

Example: ResumeHrcPair Command

```
Start $Script="HRC",$Svr="CU-Name"

// $Dev
SetList $D =_ilDevA, $S = {0x0100,0x0101,0x0102,259}
// $Priority
SetList $D =_ilWorkC, $S = {24,32,0x13,8}

ResumeHrcPair $Dev = _ilDevA, $Priority = _ilWorkC
StartHrcPair

// $Dev
SetList $D =_ilDevB, $S = {0x0200,0x0201,0x0202,0x0203}
AddList $D =_ilDevB, $S = {0x0904,0x0905,0x0906,0x0907}

ResumeHrcPair $Dev = _ilDevB, $OptRsmRange = "Volume"
StartHrcPair

End
```

Change Pair Options

Use the ChangeHrcOption command to change the pair options for TC390 pairs. The ChangeHrcOption parameters include:

- M-VOL device list (numeric): $C \times 0x100 + VV$, where $C=CU\#$, $VV=vol\#$ within CU.
- Fence level list (string): "N" or "Never" (0x00) = never, "S" or "Status" (0x02) = status; "D" or "Data" (0x01) = data; default = current value. For async pairs you must either specify N or omit this parameter.
- CFW flag list (numeric): 0 = copy CFW data to R-VOL; 1 = only M-VOL; default = current value.
- DFW flag list (numeric): DFW flag list is only left to maintain the compatibility of the format. The specification is not available.
- Error level list (string): "G" (0x00) = group; "V" (0x01) = volume; default = current value. For sync pairs you must omit this parameter.
- Time-Saving Mode flag: "Yes" = The **Use Time-Saving Mode** option is enabled; "No" = The **Use Time-Saving Mode** option is disabled; default = "Yes". This parameter is a non-list type and only one value can be specified.

The following provides an example of the pair macro commands needed to change the pair options for the pair with LDEV ID 0x4a as follows: set fence level option to **Never** and set CFW option to M-VOL only.

Example: ChangeHrcOption Command

```
Start $Script="HRC",$Svr="CU-Name"

// $Dev
SetList $D =_ilDevA, $S = {0x0100,0x0101,0x0102,0x0103,0x0104}
AddList $D =_ilDevA, $S = {0x0117,0x0118,0x0119}
// $OptCfw
SetList $D = _ilWorkA, $S = {1, 1, 0}
// $Fence
SetList $D = _slWorkA, $S = {"D", "S", "N", "Data", "Status"}

ChangeHrcOption $Dev = _ilDevA, $Fence = _slWorkA, $OptCfw =
_ilWorkA

// $Dev
SetList $D =_ilDevB, $S = {0x0A00,0x0A01,0x0A02,0x0A03,0x0A04}
// $OptErrLv
SetList $D = _slWorkB, $S = {"G", "V", "Volume", "Group"}

ChangeHrcOption $Dev = _ilDevB, $OptErrLv = _slWorkB

End
```

Starting a Pair

The StartHrcPair command starts the remote copy process for all new and resumed TC390 pairs (CreateHrcPair and ResumeHrcPair commands). The StartHrcPair command does not have any arguments or parameters. After you have created and/or resumed all needed TC390 pairs, add the StartHrcPair command to the script to begin remote copy activity for all preceding new and resumed pairs. The following provides an example of the StartHrcPair command as it is displayed within a script file.

Example: StartHrcPair Command

```
:
:
StartHrcPair
```

Getting Pair Status

The GetHrcStatus macro command obtains the status of a specific TC390 pair. The GetHrcStatus argument is:

- Device (numeric constant, non-list-type and numeric-type work variable): VOL = C x 0x100 + VV, where C=CU#, VV=vol# within the CU.

The GetHrcStatus command obtains the status of the pair from the XP128/XP1024/XP12000 and displays the status as a reserved variable “_HrcStatus” (see [Table 56](#) on page 213). The following provides an example of the GetHrcStatus command for the pair with LDEV ID 0x4a.

Example: GetHrcStatus Command

```
GetHrcStatus $Dev=0x4a
_sMsgB=_HrcStatus_Fence
_sMsgC=_HrcStatus_Sync
_sMsgD=_HrcStatus_Sn
_iNumB=_HrcStatus_Ssid
_iNumC=_HrcStatus_DeviceR
```

Selecting Devices

The SelectHrcDevice command searches for TC390 pairs whose status matches the specified parameters. The SelectHrcDevice argument is:

- Output list (list-type and numeric work variable)

The SelectHrcDevice parameters include:

- Device list (numeric): list of devices to be searched: C x 0x100 + VV, where C=CU#, VV=vol# within CU. Default = all possible target devices that can be specified. The maximum number of the device is 1,024. When you search for more than 1,024 devices, use this command for several times.
- Serial number list (string): RCU serial number. Default = not specific.
- SSID number list (numeric): RCU SSID. Default = not specific.
- Fence level list (string): "N" or "Never" (0x00) = never; "S" or "Status" (0x02) = status; "D" or "Data" (0x01) = data. Default = not specific.
- Sync level list (string): "S0" or "Synchronous0" (0x00) = sync, "S2" or "Synchronous2" (0x02) = async. Default = not specific.
- Pair status list (string): "Simplex", "Pending", "Duplex", "Suspended0" (suspended during initial copy), "Suspended1" (suspended after initial copy), "Suspended" (all suspend types), "Suspending", "Deleting", "Undefined". Default = not specific.
- Device attribute list (string): "M" or "M-Vol", "R" or "R-Vol". Default = not specific.
- Error level list (string): "G" or "Group"; "V" or "Volume". Default = not specific.
- CT group list (numeric): consistency group number (0x00 - 0x7F). Default = not specific.
- SEQCHK flag list (string): "Yes" = SEQCHK on; "No" = SEQCHK off. Default = not specific.

The following SelectHrcDevice command output provides an example of the SelectHrcDevice command to find the pairs with the parameters listed in the following table.

Table 49 Select device parameters

Parameter	Value
Output list	_ilDevA
Device list	_ilDevB
RCU serial number	_slWorkA
RCU SSID	_ilWorkA
Fence level	N

Table 49 Select device parameters (continued)

Parameter	Value
Copy mode	S0, S0, S0
Pair status	Suspended0
Device attribute	M

Example: SelectHrcDevice Command

```

Start $Script="HRC", $Svr="CU-Name"

// $Dev
SetList $D =_ilDevB, $S =
{0x0F00,0x0F01,0x0F02,0x0F03,0x0F04,0x0F05,0x0F06,0x0F07}
AddList $D =_ilDevB, $S =
{0x0F10,0x0F11,0x0F12,0x0F13,0x0F14,0x0F15,0x0F16,0x0F17}
AddList $D =_ilDevB, $S =
{0x0F20,0x0F21,0x0F22,0x0F23,0x0F24,0x0F25,0x0F26,0x0F27}
AddList $D =_ilDevB, $S =
{0x0F30,0x0F31,0x0F32,0x0F33,0x0F34,0x0F35,0x0F36,0x0F37}
AddList $D =_ilDevB, $S =
{0x0F40,0x0F41,0x0F42,0x0F43,0x0F44,0x0F45,0x0F46,0x0F47}
AddList $D =_ilDevB, $S =
{0x0F50,0x0F51,0x0F52,0x0F53,0x0F54,0x0F55,0x0F56,0x0F57}

SelectHrcDevice $DevList = _ilDevA, $Dev = _ilDevB, $Sync = "Synchronous2",
$PairStatus = "Suspend"

DeleteHrcPair $Dev = _ilDevA

End

```


Internal Macro Commands

The internal macro commands are the connection agents that connects the functional macros together and produces a complete and functioning script. The internal macros are divided into two groups as shown in the following table: list types and non-list types.

Table 50 Internal macro commands

Type	Macro	Description
For lists	SetList	Set (define) a list of items.
	AddList	Add items to a list.
For non-lists	Start	Declares the beginning of a script.
	End	Declares the end of a script.
	Delay	Suspends script execution for the specified length of time.
	If	Executes a script conditionally.
	EndIf	Terminates a script conditionally.
	MakeString	Makes strings; converts numeric value to character string.

The **Start** and **End** commands are used together to begin and end the functions of a script. Every script must have a **Start** and **End** command. The **If/EndIf** commands are also used concurrently to string two or more functional commands together. The **If/EndIf** commands must be used together. For every **If** command in a script there must be an **EndIf** command. Use the **Delay** command to delay a script for up to an hour. Use the **MakeString** command to assign several values to a string statement. The **MakeString** command can convert numeric values to sting values. The **SetList** command creates a list (for example, all the searchable ports in the XP128/XP1024/XP12000, all the searchable LDEVs in the XP128/XP1024/XP12000) and the **AddList** command expands the parameters of a list created with the **SetList** command.

Internal Macro Command Definitions

AddList

The **AddList** command adds a specified value to a specific list type. If you add a value to a list that exceeds the maximum number of items for that output list, the excess values will be ignored. The format for the **AddList** command is: **AddList \$D=** the output list to which you want to add a value **,\$S=** the expressions or values to be added to the output list with a numeric range of 0x0000 to 0xffff. For example, to add these values (0, 1, 2, 3, 0x1e, and 0x1f) to the Dev (Device) B list, the **AddList** command would be:

```
AddList $D=_ilDevB
,$S={0,1,2,3,0x1e,0x1f}
```

Delay

Use the **Delay** command to delay a script for a specified length of time. The script delay time is set in seconds (0 - 3600). The format for the **Delay** command is: **Delay \$Time=** the length of time you want to delay the script. For example, to delay a script by 60 seconds, the **Delay** command would be:

```
Delay $Time=60
```

End

Use the **End** command to declare the end of a script. The **End** command also terminates the execution of a script. At least one **End** statement must be described in the trailing line of the script statement. The format for the **End** statement is:

End

If/EndIf

The **If/EndIf** statements are used together to verify the conditions of an expression. If the **If/EndIf** statement is successfully completed, succeeding statements will be processed. If the **If/EndIf** statement is not successfully completed, the script will abort and the succeeding statements will not be completed. When **If/EndIf** statements are used, several conditions must be met. You must end an **If** statement with an **EndIf** statement. The execution statement cannot be defined on the same line as the **If** statement. The **If** statement must contain one conditional decision statement within parentheses. The string values must be compared as ASCII character codes (see [Table 51](#)). The format for an **If/EndIf** statement is:

If expression one compared with expression two (see [Table 51](#) for comparison expressions)
macro statement, either internal or functional
EndIf

For example, to start a TC390 pair only if the pair was created successfully (result value of CreateHrcPair command is not 0), use the following **If/EndIf** command:

```
If (_Result!=0)
StartHrcPair
EndIf
```

Table 51 ASCII character codes

Character	Code
0	0x30
1	0x31
9	0x39
A	0x41
Z	0x5a
a	0x61
z	0x7a

Table 52 If/EndIf comparison symbols

Symbol	Meaning
=	Expression 1 is equal to Expression 2.
<	Expression 1 is less than Expression 2.
<=	Expression 1 is less than or equal to Expression 2.
>	Expression 1 is greater than Expression 2.
>=	Expression 1 is greater than or equal to Expression 2.
!=	Expression 1 is not equal to Expression 2.

MakeString

Use the **MakeString** command to edit a string and/or convert numeric values to string characters. When using the **MakeString** statement several conditions must be met. For each format control string statement there must be an **\$Item** statement. The format control string of expression 1 must be enclosed in quotation marks (""). If you set a value exceeding the maximum length of a string, the extraneous portion of the value will be not set. The following table defines the two expression statement in the **MakeString** command. The format for the **MakeString** command is:

MakeString \$D= output buffer , \$Fmt= expression 1, \$Item= expression 2

Table 53 MakeString expression definitions

Expression 1	Expression 2
Expression 1 is one of three format control strings (\$Fmt): %d Converts a 16-bit numeric expression to a decimal number (0 - 65535). %x Converts a 16-bit numeric expression to a hexadecimal number (0 - 0xffff). %s Sets a string as it is.	Expression 2 is any expression not containing a list reserved variable (must be constant or work variable).

For example, to create a **MakeString** statement that will convert the 16-bit numeric expression to a hexadecimal number (0 - 0xffff) and set the string as it is, with an output buffer of _sMsg, the command would be:

```
MakeString $D=_sMsgB
, $Fmt="EndCode=(0x%x):%s"
, $Item=_Result,_sMsgA
```

For the **MakeString** command listed above: _sMsgB = "EndCode=(0x110f):Error Occurred".

SetList

Use the **SetList** command to assign specific items to a list. The format of the **SetList** command is: **SetList** \$D= output list, \$S=expression(attribute of the items to be assigned to the list with a numeric range of 0x0000 to 0xffff). For example, to set 0, 1, 2, 0x1e, and 0x1f to be displayed in the Dev (Device) B list the command would be:

```
SetList $D=ilDevB, $S={0,1,2,0x1e,0x1f}
```

Start

Use the **Start** command to declare the beginning of a script and check to verify that the controller name matched the connected controller. When using the **Start** command, several conditions must be met. The **Start** command must be described on the first line of the script. The **Start** statement cannot include a comment statement, an empty statement or a blank statement. The **Start** statement must be displayed at the beginning of every script. If the controller name does not match the connected controller, an error will occur and the script will be aborted. The format of the **Start** command is: **Start** \$Script="HRC", \$Svr= controller name. For example, to start a script for a controller named Training XP1024 the command would be:

```
Start $Script="HRC", $Svr="Training XP1024"
```



NOTE: The controller name check is not available for this version. Therefore, the contents of the **\$Svr** does not affect the script file execution.

Work Variables

There are two types of work variables: list type and non-list type. All work variables are initialized before a script is executed.

- Numeric work variables may have a value between 0x0000 and 0xffff. Numeric work variables are initialized with 0.
- A non-list string work variable may have a string with length up to 150 bytes. A list string work variable may have strings with length up to 16 bytes each. String work variables are initialized with a null string whose length is 0.
- A list work variable may have up to 1,024 items. A non-list work variable is a constant. List work variables are initialized as empty (no items).

The work variable is part of an execution statement in a script. The following table provides a description and the storage type of each work variable statement for list and non-list types.

Table 54 Work variables

	Variable	Type	Description and Storage Type
List Type	_iDEV	Numeric	Stores the device number list. Expression: _iDevA, _iDevB, _iDevC
	_iPriority	Numeric	Stores the priority number list. Expression: _iPriorityA, _iPriorityB, _iPriorityC
	_iWork	Numeric	Stores any 16-bit numeric values. Expression: _iWorkA, _iWorkB, _iWorkC, _iWorkD, _iWorkE, _iWorkF
	_sWork	String	Stores any strings. Expression: _sWorkA, _sWorkB, _sWorkC, _sWorkD, _sWorkE, _sWorkF
Non-List Type	_iNum	Numeric	Stores any 16-bit numeric value. Expression: _iNumA, _iNumB, _iNumC, _iNumD, _iNumE, _iNumF
	_sMsg	String	Stores any string. Expression: _sMsgA, _sMsgB, _sMsgC, _sMsgD, _sMsgE, _sMsgF

Reserved Variables

Reserved variables include result variables (that is, result of macro execution) and status variables (that is, pair status of specified volume). The reserved variables are for reference use only.

Reserved Result Variables

When a functional macro is executed (for example, CreateHrcPair), a result value (_Result) is issued. The following figure illustrates the result statement format, and the following table lists and defines the valid result values. When a new macro is initiated, the result value automatically resets to 0x0000. The functional macro executes on the specified number of devices. If the macro does not satisfy the execution condition, a conditional error occurs. If a conditional error is found, the result value is OR'ed with 0x1000, and the macro is logged in the error and macro trace files (see ["Script Operations Window"](#) on page 84). If the return value of the API (application program interface) is not 0, an API error occurs. If an

API error occurs, the result value is OR'ed with 0x0100, and the macro is logged in the error and macro trace files.

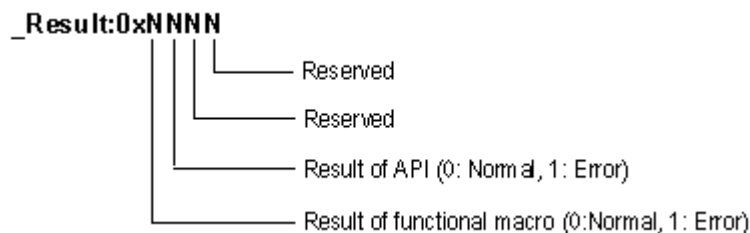


Figure 73 Result statement format

Table 55 Reserved result variables

Variable	Type	Description
<code>_Result</code>	Numeric	Stores the execution results of a macro. 0 = normal end. Other values depend on the macro.
<code>_MsgResult</code>	Numeric	Stores the execution results of a Message (internal) macro. 1 = OK, 6 = Yes, 7 = No.
<code>_SelectResult</code>	Numeric	Stores the number of devices found by <code>SelectHrcDevice</code> macro. 0 = no devices found.

Reserved Status Variables

When a `GetHrcStatus` command is issued, the Command View management station obtains the status of the specified TC390 pair(s) from the XP128/XP1024/XP12000. The results of this query are displayed in the reserved status variables. The following table lists and describes the valid reserved status variables.

Table 56 Reserved status variables

Variable	Type	Description
<code>_HrcStatus _CopyType</code>	String	Stores the copy type: "RDC" = remote copy mode; "RMC" = migration mode; "..." = other than the above modes.
<code>_HrcStatus _DeviceAttr</code>	String	Stores the device attribute: "M-Vol" = M-VOL; "R-Vol" = R-VOL; "..." = other than the above modes.
<code>_HrcStatus _DeviceM</code>	Numeric	Stores the M-VOL device number.
<code>_HrcStatus _DeviceR</code>	Numeric	Stores the R-VOL device number.
<code>_HrcStatus _Sn</code>	String	Stores the serial number of the controller for the remote copy pairs.

Table 56 Reserved status variables (continued)

Variable	Type	Description
_HrcStatus _Ssid	Numeric	Stores the storage subsystem ID (SSID) of the controller for the remote copy pairs.
_HrcStatus _PairStatus	String	Stores the copy pair status: "Simplex" = simplex; "Duplex" = duplex; "Pending" = initial copy in progress; "Suspended0" = copy abort in initial copy; "Suspended1" = copy abort other than initial copy; "Suspending" = TC390A suspend in progress; "Deleting" = TC390A delete in progress; "Undefined" = undefined.
_HrcStatus _Fence	String	Stores the M-VOL fence level: "Never" = no fence; "Status" = fence due to an R-VOL status change failure; "Data" = fence due to a data error; "Undefined" = undefined.
_HrcStatus _Sync	String	Stores the synchronous level: "Synchronous0" = sync; "Synchronous2" = async; "Undefined" = undefined.
_HrcStatus _TimeOfUpdate	String	Stores the pair status update time: "MM/DD/YYYY hh:mm:ss" = MM: month, DD: day, YYYY: year, hh: hour, mm: minute, ss: second.
_HrcStatus _TimeOfEstablish	String	Stores the pair creation update time: "MM/DD/YYYY hh:mm:ss" = MM: month, DD: day, YYYY: year, hh: hour, mm: minute, ss: second.
_HrcStatus _CopyRatio	Numeric	Stores the copy progress ratio (0 – 100).
_HrcStatus _InternalStatus	Numeric	Stores the internal status code.

Table 56 Reserved status variables (continued)

Variable	Type	Description
_HrcStatusTypeOfCT	String	Stores the timer type of the consistency group: "System" = system timer; "Local" = local (SVP) timer; "None" = no timer; "Undefined" = undefined.
_HrcStatus_CTG	Numeric	Stores the consistency group number: 0x00-0x7F.
_HrcStatus_SuspendBy	String	Stores the async suspension status: "Group" = consistency time of suspended volume matches consistency time of group; "Volume" = consistency time of suspended volume does not match the group consistency time; "Undefined" = undefined.
_HrcStatus_ErrLv	String	Stores the error level (async) pair option: "Group" = all volumes in the group will be suspended if this volume is suspended; "Volume" = this volume will be suspended individually; "Undefined" = undefined.

Optional Script Parameters

The parameters outlined in the following table are optional parameters that can be added to a script at the script creator's discretion. If any of these parameters are included in a script, the XP128/XP1024/XP12000 will perform a syntactical check of the script to ensure that the syntax requirements for the parameter have been met. If no optional parameters are included, the XP128/XP1024/XP12000 will not check any part of the script. The XP128/XP1024/XP12000 will run the script commands based only on what has been specified in the text of the script. The following table describes the syntax requirements that will be evaluated.

Table 57 Syntax requirements for optional parameters

Parameter	Syntax Requirements
Length	Check that each line does not exceed the maximum length for a script statement.
Phrases in a script statement	<p>A phrase is enclosed by the quotation symbols.</p> <p>Use of the parentheses is correct and the number of parentheses is exact.</p> <p>A statement does not terminate with an equal sign.</p> <p>The parameter identification name (phrase beginning with "\$") is always defined.</p> <p>The work variable and reserved variable (phrase beginning with "_") are always defined.</p>

Table 57 Syntax requirements for optional parameters (continued)

Parameter	Syntax Requirements
Script statement	<p>The first line begins with (Start) as an execution statement.</p> <p>The lead of one line in the execution statement always begins with a macro name or an identification name for non-list type work variable.</p>
Substitute statement	<p>The number of phrases is correct.</p> <p>The equal sign is described exactly between the right side and the left side.</p> <p>The right side of the substitute statement is correct.</p>
SetList, AddList	<p>The number of phrases is not less than the minimum count.</p> <p>Duplicate parameter identification names are not specified.</p> <p>The required parameter identification name is defined.</p> <p>The equal sign is described between the right side and \$D.</p> <p>Specifying the right side is correct.</p> <p>The equal sign is described between the right side and \$S.</p> <p>Specifying the right side is correct.</p> <p>The parameter identification name is described immediately after the macro.</p> <p>The parameter identification names are delimited by a comma (,).</p> <p>An illegal phrase is not included in any statement.</p>
Start	<p>The number of phrases is not fewer than the minimum count.</p> <p>Duplicate parameter identification names are not specified.</p> <p>The required parameter identification name is defined.</p> <p>The equal sign is described between the right side and \$Script.</p> <p>Specifying the right side is correct.</p> <p>The equal sign is described between the right side and \$Svr.</p> <p>Specifying the right side is correct.</p> <p>The parameter identification name is described immediately after the macro.</p> <p>The parameter identification names are delimited by a comma (,).</p> <p>An illegal phrase is not included in one statement.</p>
End	<p>Check that the number of phrases matches.</p>
Delay	<p>The number of phrases matches.</p> <p>The required parameter identification name is defined.</p> <p>The equal sign is described between the right side and \$Time.</p> <p>Specifying the right side is correct.</p>

Table 57 Syntax requirements for optional parameters (continued)

Parameter	Syntax Requirements
If	<p>The number of phrases matches.</p> <p>The parentheses are described in the correct location.</p> <p>Expressions 1 and 2 are correctly described.</p> <p>The attribute of expressions 1 and 2 matches.</p> <p>Specifying the right side is correct.</p> <p>The comparison operator is correctly described.</p>
EndIf	<p>The number of phrases matches.</p> <p>The macro is describe with the related If statement.</p>
MakeString	<p>Duplicate parameter identification names are not specified.</p> <p>The required parameter identification name is defined.</p> <p>The equal sign is described between the right side and one of \$D, \$Fmt and \$Item.</p> <p>Specifying the right side is correct.</p> <p>The items are split by a comma (,) if multiple items are specified in \$Item.</p> <p>The parameter identification name is described immediately after the macro.</p> <p>The parameter identification names are delimited by a comma (,).</p> <p>The matching between the specification of the control string and the description of the item is correct.</p> <p>An illegal phrase is not included in any statement.</p>
Message	<p>The number of phrases is not less than the minimum count.</p> <p>Duplicate parameter identification names are not specified.</p> <p>The required parameter for the identification name is defined.</p> <p>The equal sign is described between the right side and \$Msg.</p> <p>Specifying the right side is correct.</p> <p>The equal sign is described between the right side and \$OptMsg.</p> <p>Specifying the right side is correct.</p> <p>The parameter identification name is described immediately after the macro.</p> <p>The parameter identification names are delimited by a comma (,).</p> <p>An illegal phrase is not included in one statement.</p>

Table 57 Syntax requirements for optional parameters (continued)

Parameter	Syntax Requirements
Functional macro (except for StartHrcPair)	<p>The number of phrases is not less than the minimum count.</p> <p>Duplicate parameter identification name is prohibited.</p> <p>The required parameter for the identification name is defined.</p> <p>The equal sign is described between the right side and the parameter identification name.</p> <p>Specifying the right side is correct.</p> <p>The parameter identification name is described immediately after the macro.</p> <p>The parameters for the identification names are delimited by a comma (,).</p> <p>An illegal phrase is not included in any statement.</p>
StartHrcPair	<p>Check that the number of phrases matches.</p>
Entire check	<p>Check that the (If) has a matching (EndIf).</p> <p>Check that the last line in the execution statement terminates at (END.)</p>

Error Reporting

The TC390 scripting error codes are slightly different from the general TC390 error codes. The following figure shows the format of the scripting error codes. The following table describes the TC390 scripting error messages. [Table 59 on page 219](#) lists the TC390 scripting error codes. The message ID is the four-digit number displayed on the error message. The internal code is the four-digit number displayed in the fifth column of the error trace file (refer to "[Script Operations Window](#)" on page 84). For additional TC390 troubleshooting information, refer to "[Troubleshooting](#)" on page 153.

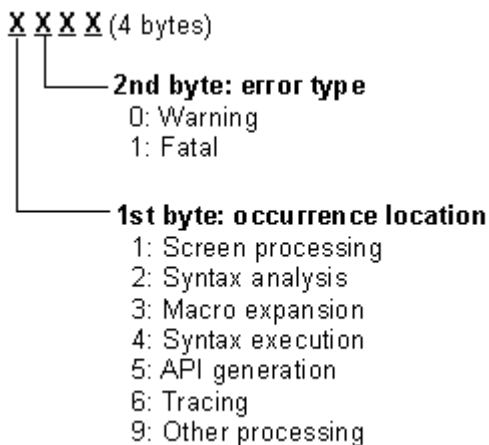


Figure 74 Scripting error code format

Table 58 Error messages

Error Message	Conditions to Verify	Corrective Action
Syntax error	The syntax validity of the script is checked at the start of execution. An error message will be displayed if failed.	Use the scripting error code to determine which line contains the syntax error (see Table 59 on page 219) and fix the syntax error.
Parameter error	The parameter validity of the script is checked on executing each instruction. An error message will be displayed if failed.	Use the scripting error code to determine which line contains the parameter error (see Table 59 on page 219) and fix the parameter error.
Rejection	The result of the execution is checked on each target device. If failed, the last error status is displayed and error flag is set in the reserved variable <code>_Result</code> . Also script continues to be executed.	If you want to terminate the script or display a message of error occurrence and indication following steps, check that <code>_Result</code> is not 0 in script.
Skip if not executable	The condition of each target device is checked to be executable status. For example, the M-VOL status must be <i>simplex</i> to create a pair. If failed, error flag is set in the reserved variable <code>_Result</code> . Also script continues to be executed.	If you want to terminate the script or display a message of error occurrence and indication following steps, check that <code>_Result</code> is not 0 in script.

Table 59 TrueCopy scripting error codes

Message ID	Internal Code	Error Message	Error Description
2338	-	Normal End.	The script execution has completed successfully.
2339	1102	Cannot open a file by 'Memo' command.	The 'Memo' command cannot start the Write application. The Write.exe file may be absent from the Windows directory.
2340	1103, 1104	Invalid command line parameter.	An error is found in the startup parameter of the script monitor. The installation process may not have been complete.
2340	1105	Invalid command line parameter (1st parameter).	Start parameter (the 1st parameter) is invalid.
2340	1106	Invalid command line parameter (2nd parameter).	Start parameter (the 2nd parameter) is invalid.
2340	1107	Invalid command line parameter (3rd parameter).	Start parameter (the 3rd parameter) is invalid.
2340	1108	Invalid command line parameter (4th parameter).	Start parameter (the 4th parameter) is invalid.
2340	1109	Invalid command line parameter (5th parameter).	Start parameter (the 5th parameter) is invalid.
2340	110A	Invalid command line parameter (6th parameter).	Start parameter (the 6th parameter) is invalid.

Table 59 TrueCopy scripting error codes (continued)

Message ID	Internal Code	Error Message	Error Description
2340	110B	Invalid command line parameter (Too short).	Start parameter is not enough
2340	1200	Memory allocation error.	Failed to allocate the memory.
2340	1201	Memory lock error.	Failed to lock the memory.
2341	1f01, 1f02	File I/O error (parameter).	The parameter file cannot be opened. The installation process may not have been complete.
2341	2f01, 2f02	File I/O error (script).	The specified file may be corrupt.
2341	2f03~ 2f05, 4101, 4102	File I/O error (temporary).	The work middle file is abnormal. The disk capacity maybe insufficient or the file may be corrupt.
2341	6101~ 6105	File I/O error (trace).	The macro trace file cannot be opened. The disk capacity may be insufficient or the file may be corrupt.
2341	6111~ 6115	File I/O error (trace).	The error trace file cannot be opened. The disk capacity may be insufficient or the file may be corrupt.
2342	2101	Too long line. Line = nnnn	A script line exceeds the maximum character length (240), where nnnn is the script line number.
2343	2201, 2203	Illegal 'If' and 'EndIf' pair. Line = nnnn	'If' and 'EndIf' script commands do not match, in script line nnnn
2344	2202	'End' is required. Line = nnnn	'End' does not exist at the end of the script line nnnn.
2345	2204	'Start' is required. Line = nnnn	The script line nnnn does not begin with 'Start.'
2346	2205	Illegal word is found. Line = nnnn	An illegal word was found in script line nnnn.
2347	2206	List type variable is unexpected. Line = nnnn	The list type variable is incorrect in script line nnnn.
2348	2207	Illegal quotation. Line = nnnn	A quotation mark is not found at the end of a string in script line nnnn.
2349	2208	Required value is not found. Line = nnnn	The end of line nnnn is "=".
2350	2209, 220a	Illegal '('and')' pair. Line = nnnn	The parentheses are not matched in script line nnnn.
2351	220b, 2303	Syntax error. Line = nnnn	An illegal word is included in script line nnnn.

Table 59 TrueCopy scripting error codes (continued)

Message ID	Internal Code	Error Message	Error Description
2351	27xx	Syntax error. Line = nnnn	The parameter setting for script line nnnn is invalid.
2351	274A	Syntax error.	Syntax error for the \$Diff parameter line.
2351	274B	Syntax error.	Syntax error for the \$TimeSave parameter line.
2351	29xx	Syntax error. Line = nnnn	The macro description for script line nnnn is invalid.
2351	2axx	Syntax error. Line = nnnn	An invalid comma is used in script line nnnn.
2351	2A4B	Syntax error.	A comma is required after the \$Diff parameter.
2351	2A4C	Syntax error.	A comma is required after the \$TimeSave parameter.
2352	220e	Illegal expression. Line = nnnn	An unavailable operator is defined in the if statement of script line nnnn.
2353	220f	Illegal parameter. Line = nnnn	The list of the format control string and the value of the expression specified by \$Item do not match in the Make String command. Or, the format control string and the expression do not match the attributes in script line nnnn.
2353	24xx	Illegal parameter. Line = nnnn	The parameters of script line nnnn are invalid.
2354	2301	Unknown parameter. Line = nnnn	An undefined parameter is used in script line nnnn.
2355	2355	Unknown identifier. Line = nnnn	An undefined word is used to define the parameters in script line nnnn.
2356	25xx	Same parameter appears again. Line = nnnn	A duplicate parameter was found in script line nnnn.
2356	254A	Same parameter appears again.	Same parameter (\$Diff) is used more than once.
2356	254B	Same parameter appears again.	Same parameter (\$TimeSave) is used more than once.
2357	26xx	Required parameter is not found. Line = nnnn	A required parameter for script line nnnn was not found.
2358	28xx	Value type mismatch. Line = nnnn	The values on the left and right side of script line nnnn are not compatible.
2358	285C	Value type mismatch.	The value type for the \$Diff parameter are not compatible.
2358	285D	Value type mismatch.	The value type for the \$TimeSave parameter are not compatible.

Table 59 TrueCopy scripting error codes (continued)

Message ID	Internal Code	Error Message	Error Description
2359	1001, 4111, 4112	Internal error.	An internal program error has occurred. The program installation may not have been complete.
2360	4181	Mismatch script type.	The script types specified by the Start macro and by the execution environment file are different.
2361	4182	Mismatch controller name.	The device names specified by the Start macro and by the execution environment file are different.
2362	5101	Parameter value error (\$Dev).	A functional macro parameter error was found. Check the setting value in the \$Dev parameter.
2362	5102	Parameter value error (\$Priority).	A functional macro parameter error was found in setting \$Priority.
2362	5103	Parameter value error (\$Fence).	A functional macro parameter error was found in setting \$Fence.
2362	5104	Parameter value error (\$Sync).	A functional macro parameter error was found in setting \$Sync.
2362	5105	Parameter value error. (\$SusMode).	A functional macro parameter error was found in setting \$SusMode.
2362	5106	Parameter value error (\$SusReport).	A functional macro parameter error was found in setting \$SusReport.
2362	5107	Parameter value error (\$DelMode).	A functional macro parameter error is found in the setting \$DelMode.
2362	5108	Parameter value error (\$OptCfw).	A functional macro parameter error is found in setting \$OptCfw.
2362	5109	Parameter value error (\$OptSusDfwBlk).	A functional macro parameter error is found in setting \$OptSusDfwblk.
2362	5110	Parameter value error (\$RcuSn).	A functional macro parameter error was found in setting \$RcuSn.
2362	5111	Parameter value error (\$RcuSsid).	A functional macro parameter error was found in the setting \$RcuSsid.
2362	5112	Parameter value error (\$Rdev).	A functional macro parameter error was found in the setting \$Rdev.
2362	5113	Parameter value error (\$CopyPace).	A functional macro parameter error was found in the setting \$CopyPace.
2362	5114	Parameter value error (\$CopyMode).	A functional macro parameter error was found in the setting \$CopyMode.

Table 59 TrueCopy scripting error codes (continued)

Message ID	Internal Code	Error Message	Error Description
2362	5115	Parameter value error (\$PairStatus).	A functional macro parameter error was found in the setting \$PairStatus.
2362	5116	Parameter value error (\$DevAttr).	A functional macro parameter error was found in the setting \$DevAttr.
2362	5117	Parameter value error (\$OptMsg).	A functional macro parameter error was found in the setting \$OptMsg.
2362	5118	Parameter value error (\$Unit).	A functional macro parameter error was found in the setting \$Unit.
2362	5121	Parameter value error (\$RcuSn!=\$Dev).	A functional macro parameter error was found in the \$RcuSn!=\$Dev setting.
2362	5122	Parameter value error (\$RcuSsid!=\$Dev).	A functional macro parameter error was found in the \$RcuSsid!=\$Dev settings.
2362	5123	Parameter value error (\$Rdev!=\$Dev).	A functional macro parameter error was found in the \$Rdev!=\$Dev settings.
2362	5124	Parameter value error (\$CopyMode!=\$Sync).	A functional macro parameter error is found in the \$CopyMode!=\$Sync settings.
2362	5132	Parameter value error (\$CTG).	A functional macro parameter error is found. Set the correct CT group number in the \$CTG parameter.
2362	5133	Parameter value error (\$OptErrLv).	A functional macro parameter error is found. Set the correct error level in the \$OptErrLv parameter.
2362	5134	Parameter value error (\$SusRange).	A functional macro parameter error is found. Set the correct suspend range in the \$SusRange parameter.
2362	5135	Parameter value error (\$PendData).	A functional macro parameter error is found. Set the correct pending data flag in the \$PendData parameter.
2362	5136	Parameter value error (\$DelRange).	A functional macro parameter error is found. Set the correct delete range in the \$DelRange parameter.
2362	5137	Parameter value error (\$OptRsmRange).	A functional macro parameter error is found. Set the correct resume range in the \$OptRsmRange parameter.
2362	5138	Parameter value error (\$Seqchk).	A functional macro parameter error is found. Set the correct SEQCHK flag in the \$Seqchk parameter.

Table 59 TrueCopy scripting error codes (continued)

Message ID	Internal Code	Error Message	Error Description
2362	5139	Parameter value error (\$SusComplete).	A functional macro parameter error is found. Set the correct time-saving mode flag in the \$SusComplete parameter.
2362	513A	Parameter value error (\$TimeSave).	A functional macro parameter error is found in the \$TimeSave parameter.
2362	513B	Parameter value error (\$Diff).	A functional macro parameter error is found in the \$Diff parameter.
2995	5201	Illegal combination (\$Sync and \$OptSusDfwBlk).	A functional macro parameter combination error is found. (\$Sync and \$OptSusDfwBlk.)
2995	5203	Illegal combination (\$Sync and \$CTG).	A functional macro parameter combination error is found. (\$Sync and \$CTG.)
2995	5204	Illegal combination (\$Sync and \$OptErrLv).	A functional macro parameter combination error is found. (\$Sync and \$OptErrLv.)
2996	5301	\$CTG not found.	\$CTG is not described when asynchronous copy pair creation.
-	4001	Non device error.	The specified device is not mounted.
-	4002	Pair status error.	The specified command cannot be performed under this pair status.
-	4003	Volume type error.	The specified command cannot be performed with this volume type.
-	4004	Device list empty.	The description is not found in the device list of macro
-	5001	API error(GetEquipInfoEx).	An error occurred during the acquisition of the volume mounting status.
-	5002	API error(GetPairStatus2561). ErrorCode=6005 xxxx	An error occurred during the getting pair status operation.
-	5003	API error(GetPairStatus). ErrorCode=6005 xxxx	An error occurred during the getting pair status operation.
-	5004	API error(SetCreatePair). ErrorCode=6005 xxxx	An error occurred during the create pair operation.
-	5005	API error(SuspendPair). ErrorCode=6005 xxxx	An error occurred during the suspending pair operation.
-	5006	API error(ChangePairOption). ErrorCode=6005 xxxx	An error occurred during the changing pair operation.
-	5007	API error>DeletePair). ErrorCode=6005 xxxx	An error occurred during the deleting pair operation.

Table 59 TrueCopy scripting error codes (continued)

Message ID	Internal Code	Error Message	Error Description
-	5008	API error(StartCreatePair). ErrorCode=6005 xxxx	An error occurred during the copy start instruction.
-	5020	API retry(GetPairStatus256).	An error occurred at retrying the getting pair status operation.
-	4006	Too many pairs (SetList/AddList).	The number of pairs that is specified in the device list exceeds the maximum value.
-	6666	Abort by operator.	The operation is interrupted by a user.
-	6667	Abort by unlock.	The operation is interrupted according to the modify mode timeout.



NOTE: ErrorCode-6005 xxxx corresponds to the Command View XP error codes.

HXRC Device Blocking and Load Balancing

The XP128/XP1024/XP12000 supports the IBM-compatible specifications for XRC device blocking and load balancing control. In addition, the XP128/XP1024/XP12000 provides more flexible tuning methods for load balancing control under HXRC environments as shown below.

Device Blocking Function

The XP128/XP1024/XP12000 HXRC function supports the new TSO command specifications for the XRC device blocking function.

- **DONOTBLOCK option.** DONOTBLOCK is a new option parameter that is specified by the XADDPAIR command.
 - **DONOTBLOCK:** The amount of write data for application programs are blocked by the threshold specified by SDM. Default value is "500"HEX RECSETs.
 - **Specified:** When the DONOTBLOCK option is specified to a logical device, the amount of write data of application programs for the logical device is not blocked.
- **XQUERY.** The number of RECSET and the current threshold value corresponding to a logical device will be displayed by the XQUERY command.



CAUTION: If you specify the DONOTBLOCK option for too many devices, a sidefile puncture condition will occur. Use caution when determining the appropriate tuning (devices with DONOTBLOCK option, SVP modes) for your operational environment.

Load Balancing Control

Current Load Balancing Control

The XP128/XP1024/XP12000 has three fixed thresholds and three levels of load balancing for varying amounts of sidefile cache as follows: Threshold 1/2/3 = 40/50/60%.

- **Level 1:** Sidefile capacity is 40% -50% of the total cache capacity. Write I/Os are blocked by "Sleep"- "Wait" logic. The following modes are set on the XP128/XP1024/XP12000 SVP:
 - **Mode 45:** "Sleep" -"Wait" suppression option
OFF (Default): Disk array performs "Sleep"- "Wait" command retry per one write I/O to block write I/O until the amount of sidefile is less than 40% of total cache.
ON: Disk array does not perform "Sleep"- "Wait" command retry.
 - **Mode 97:** "Wait" timer control
OFF (Default): When the amount of sidefile is over 40% of total cache capacity, the XP128/XP1024/XP12000 waits 100 ms as "Sleep"- "Wait" timer for write I/O.
ON: When the amount of sidefile is over 40% of total cache capacity, the XP128/XP1024/XP12000 waits 10 ms as "Sleep"- "Wait" timer for write I/O.
- **Level 2:** Sidefile capacity is over 50% -60% of the total cache capacity. Write I/Os are blocked by "SCP"- "SCI" logic. The following modes are set on the XP128/XP1024/XP12000 SVP:
 - **Mode 98:** "SCP" reporting suppression option
OFF (Default): When the amount of sidefile is over 50% of total cache capacity, the XP128/XP1024/XP12000 reports SCP status for write I/O. Operating system cannot issue the write I/O until SCI status is received. The XP128/XP1024/XP12000 reports SCI when the amount of sidefile is less than 50% of the total cache capacity.
ON: The XP128/XP1024/XP12000 does not perform "SCP" reporting for write I/O.
- **Level 3:** Sidefile capacity exceeds 60% in the total cache capacity. Sidefile puncture occurs. The session that has the largest amount stored in sidefile cache is canceled.



NOTE: The XP128/XP1024/XP12000 SVP mode settings are preserved, even during microprogram exchange or disk array power-off.

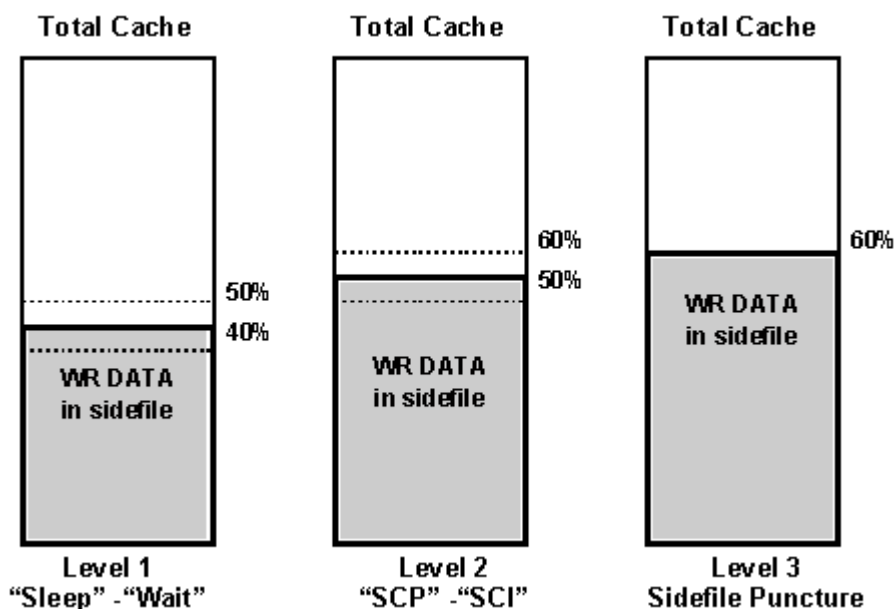


Figure 75 Current load balancing control

New Load Balancing Control

The following conditions are required to activate the new DONOTBLOCK option for the XADDPAIR TSO command:

- The operating system must support the new DONOTBLOCK option.
- Mode 61 must be ON.
If Mode 61 is OFF (default), the XP128/XP1024/XP12000 performs current load balancing control.
If the operating system does not support the DONOTBLOCK option, set Mode 61 = OFF.

DONOTBLOCK option: The XP128/XP1024/XP12000 does not block write I/Os for the specified logical device, to avoid performance impact for application programs.



CAUTION: If you specify the DONOTBLOCK option for too many devices, a sidefile puncture condition will occur. Use caution when determining the appropriate tuning (devices with DONOTBLOCK option, SVP modes) for your operational environment.

Load balancing control for sidefile: When the DONOTBLOCK option is not specified, the XP128/XP1024/XP12000 has four levels of load balancing for amount of sidefile. Level 0 control is new for load balancing control.

- Level 0: Sidefile capacity is less than threshold 1 in the total cache capacity.
MODE 45 = ON: Write I/Os for logical devices are blocked ("Sleep"- "Wait" logic) by the threshold (500 HEX RECSETS) specified by SDM.
MODE 45 = OFF: Write I/Os are not blocked.
- Level 1: Sidefile capacity is over threshold 1 - threshold 2 of the total cache capacity.
MODE 97: "Wait" timer control. Same as level 1 in current load balancing control.
- Level 2: Sidefile capacity is over threshold 2 - threshold 3 of the total cache capacity.
MODE 98: "SCP" reporting suppression option. Same as level 2 in current load balancing control.
- Level 3: Sidefile capacity exceeds threshold 3 of the total cache capacity. Sidefile puncture occurs. Same as level 3 in current load balancing control.

Variable sidefile threshold. Two new system options are assigned as variable sidefile threshold as follows. These options are effective whether Mode 61 = ON or OFF.

- MODE 85, 86
 - Combination 1: MODE 85,86 = ON,OFF – Threshold 1/2/3=30/40/50%
 - Combination 2: MODE 85,86 = OFF,OFF – Threshold 1/2/3=40/50/60% **Default**
 - Combination 3: MODE 85,86 = OFF,ON – Threshold 1/2/3=50/60/70%

- Combination 4: MODE 85,86 = ON,ON – Threshold 1/2/3=60/70/80%

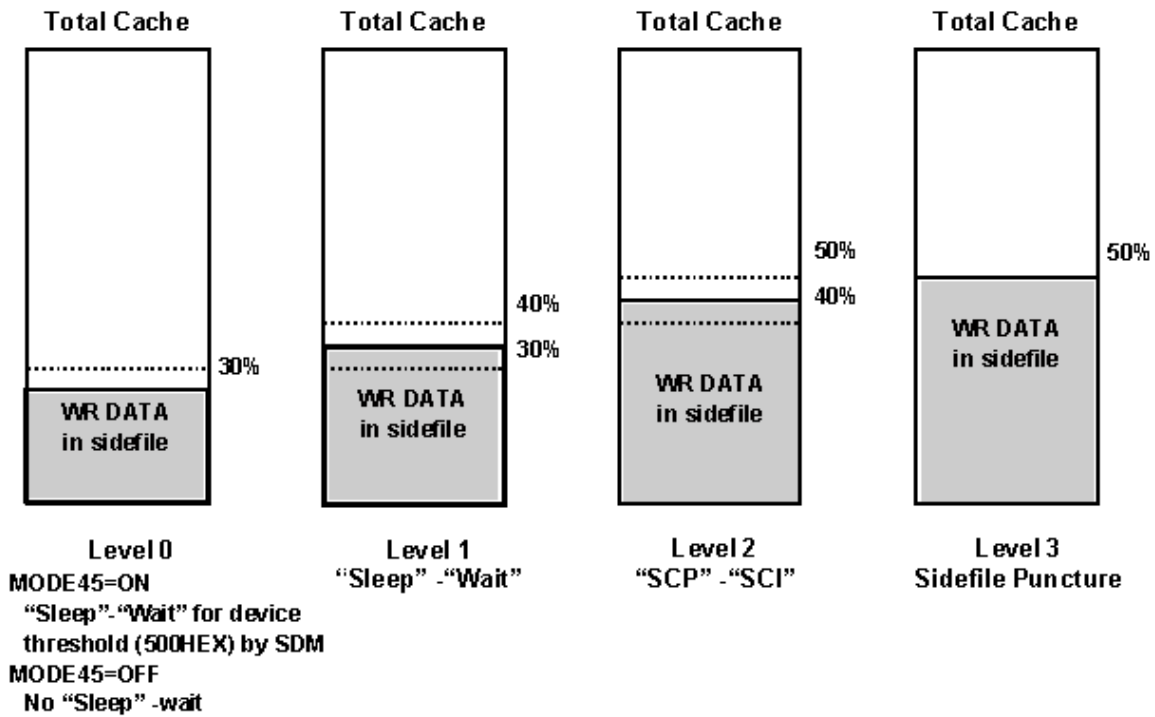


Figure 76 Combination 1: MODE 85,86 = ON,OFF; Threshold 1/2/3 = 30/40/50%

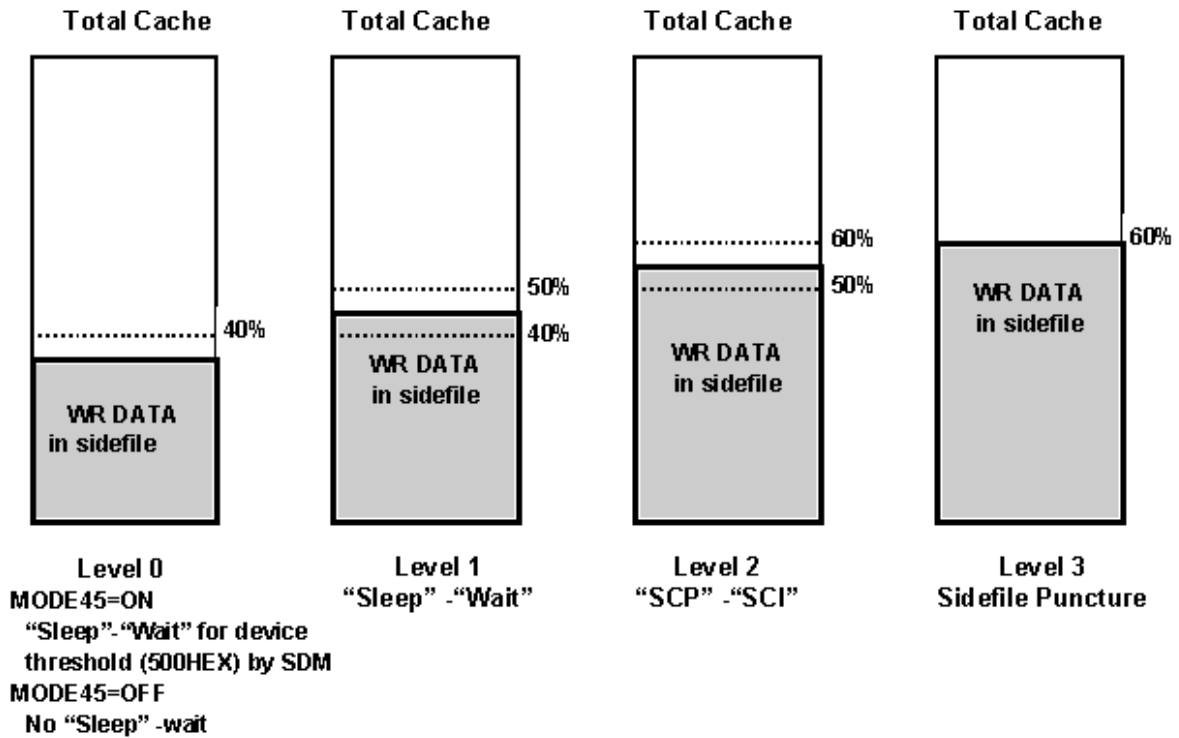


Figure 77 Combination 2 (Default): MODE 85,86 = OFF,OFF; Threshold 1/2/3 = 40/50/60%

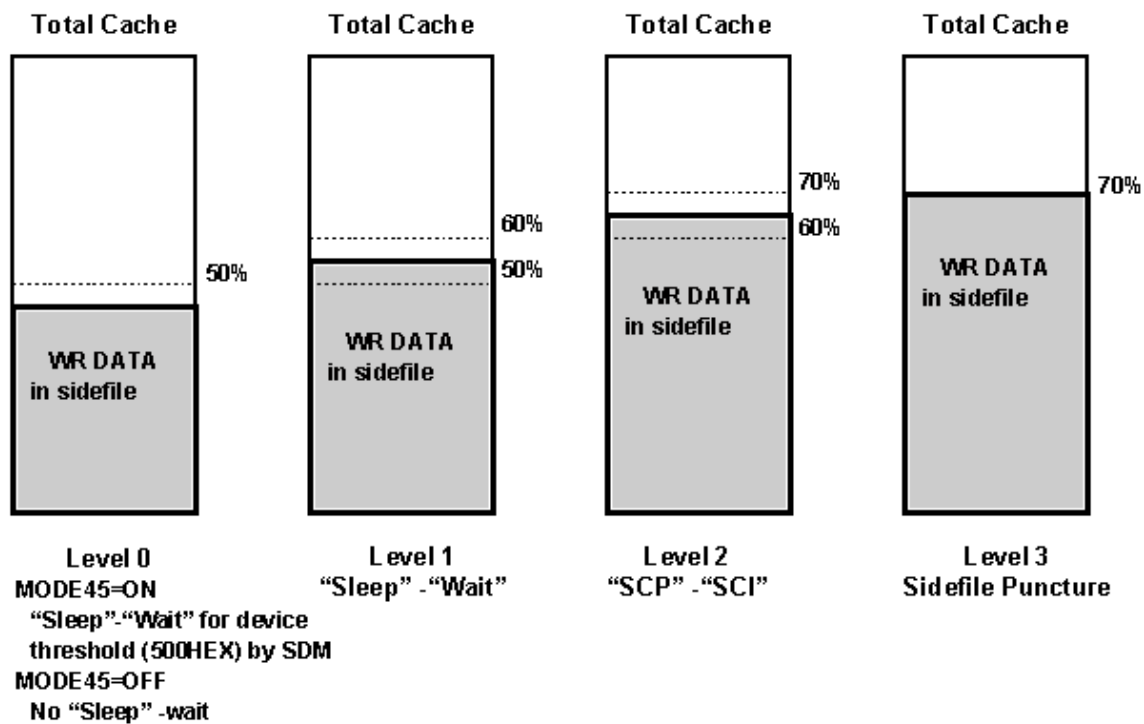


Figure 78 Combination 3: MODE 85,86 = OFF,ON – Threshold 1/2/3 = 50/60/70%

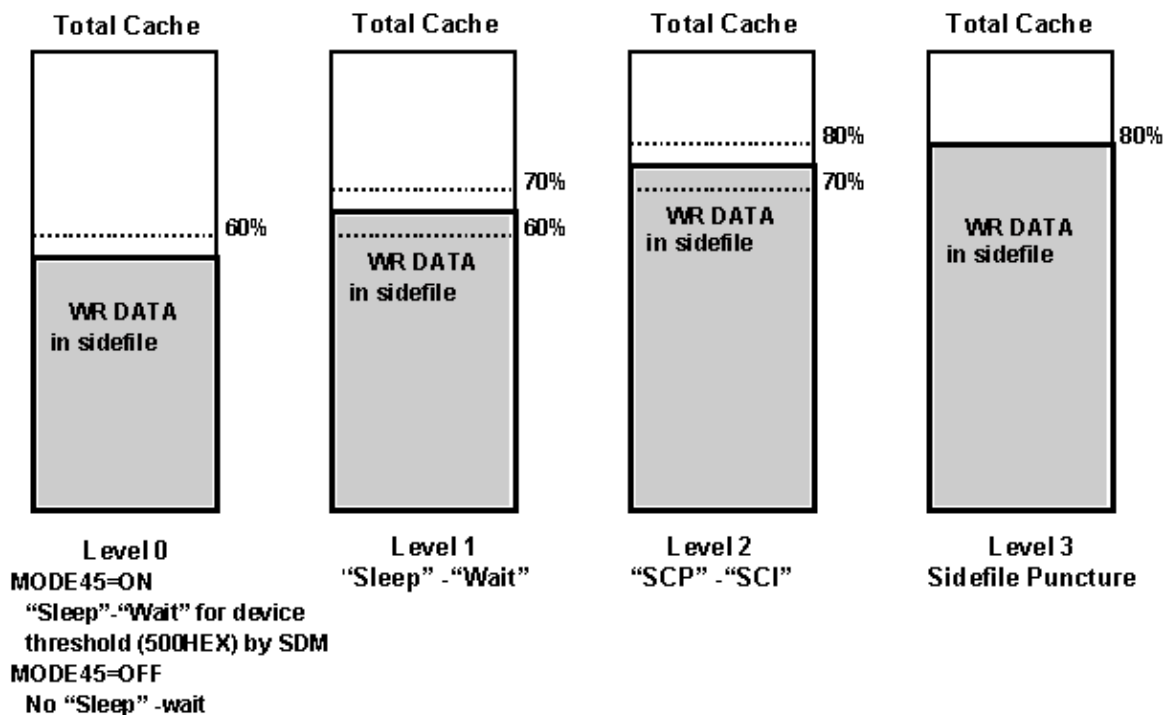


Figure 79 Combination 4: MODE 85,86 = ON,ON – Threshold 1/2/3 = 60/70/80%

2 ShadowImage for the XP128/XP1024/XP12000

ShadowImage (SI390) is a storage-based hardware solution for duplicating logical volumes that reduces backup time and provides point-in-time backup. The SI390 source volumes (S-VOLs) contain the original data and the SI390 target volume(s) (T-VOLs) contain the duplicate data. The user can choose to make up to three copies of each S-VOL. Because each T-VOL is paired with its S-VOL independently. Each T-VOL can be maintained as an independent copy set that can be split, resynchronized, and deleted separately from the other T-VOLs assigned to the same S-VOL.

ShadowImage Components

SI390 operations involve the source and target volumes in the XP128/XP1024/XP12000, Command View XP, and optionally, the IBM PPRC host software functions. The SI390 system components are:

- SI390 volume pairs (S-VOLs and T-VOLs) (see page 231)
- Command View
- (Optional) IBM PPRC host software functions (see page 232)
- (Optional) IBM DFSMSdss host software functions (see page 232)

Figure 80 shows a typical ShadowImage configuration.

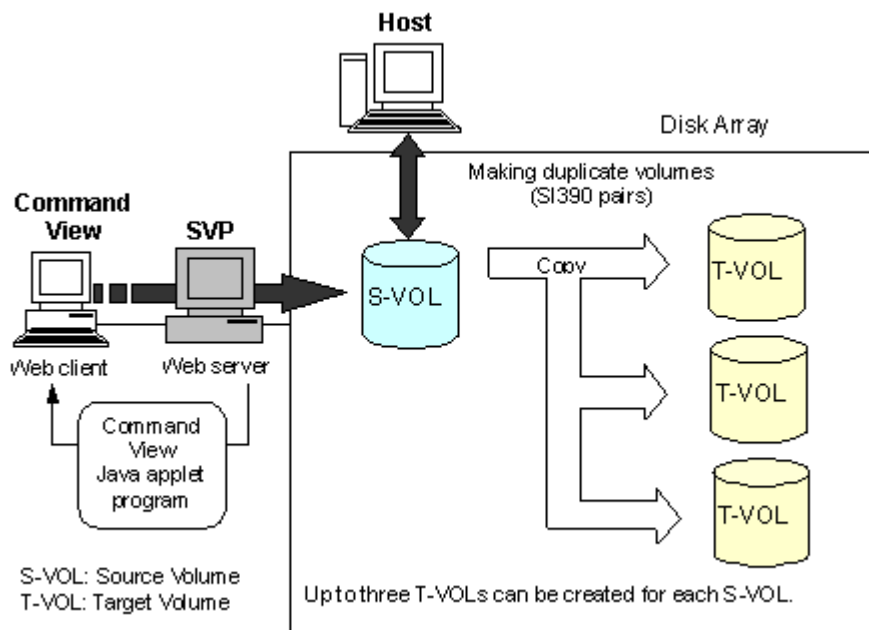


Figure 80 ShadowImage for z/OS configuration

Volume Pairs (S-VOLs and T-VOLs)

The XP128/XP1024/XP12000 contains and manages both the original and copied SI390 data. SI390 supports a maximum of 8,192 volumes (4,096 pairs: 4,096 S-VOLs and 4,096 T-VOLs).

SI390 performs internal copy operations for logical volume pairs established by the user. Each SI390 pair consists of one source volume (S-VOL) and up to three target volumes (T-VOLs) that are located in the same XP128/XP1024/XP12000. The SI390 S-VOLs are the source volumes that contain the original data. The SI390 T-VOLs are the target or secondary (mirrored) volumes that contain the backup data. Each T-VOL

must be paired with only one S-VOL. During normal SI390 operations, the S-VOLs remain available to all hosts at all times for read and write I/O operations. The T-VOLs become available for host access only after a split operation has been performed.

When an SI390 volume pair is added, the data on the S-VOL is copied to the T-VOL. During this initial copy operation and after the pair status becomes *duplex*, all write operations to the T-VOL are prohibited. If you need to access a T-VOL, you can split the pair to make the T-VOL accessible (the S-VOL is always accessible). While an SI390 pair is split, the XP128/XP1024/XP12000 keeps track of all changes to the S-VOL and T-VOL as a differential bitmap. When you resync the pair, the differential data in the S-VOL (due to S-VOL and T-VOL updates) is copied to the T-VOL so that the T-VOL is again identical to the S-VOL.



NOTE: SI390 T-VOLs are updated asynchronously. For a volume pair with duplex status, the S-VOL and T-VOL may not be identical. For more information on SI390 update copy operations, refer to [“Add Pair Operation”](#) on page 236.

SI390 S-VOLs or T-VOLs should not be concentrated in the same RAID group. To disperse workloads of the RAID groups, each RAID group should have both S-VOLs and T-VOLs evenly distributed. SI390 pairs for which an SI390 operation is performed simultaneously should be in different RAID groups. If SI390 pairs are concentrated in only a few RAID groups, the host I/O performance may be degraded. To minimize effect on the host I/O performance, take the following actions:

- Specify **Slower** for the copy pace when you create, split, or resync SI390 pairs.
- If the SI390 pairs that you want to perform copy operation are in the same ECC group, reduce the number of pairs at one copy operation. For example, to split multiple SI390 pairs in the same ECC group, wait until one pair is completely split before splitting another pair.

If the XP128/XP1024/XP12000 is overloaded, you must increase cache, disk adapters, and/or RAID groups. Consider assigning SI390 T-VOLs in the newly installed RAID groups. If you continue SI390 operations with an overloaded XP128/XP1024/XP12000, host I/O performance may be degraded.

IBM PPRC Host Software Functions

SI390 supports the IBM PPRC host software functions, including TSO PPRC commands and ICKDSF PPRCOPY commands. SI390 pairs can be added, split, resynced, and deleted using TSO PPRC or ICKDSF PPRCOPY commands. [“Using PPRC Commands for ShadowImage”](#) on page 284 describes and provides instructions for using PPRC commands to create and maintain SI390 volume pairs on the XP128/XP1024/XP12000. Also, ShadowImage - FlashCopy supports the IBM TSO PPRC commands and DFSMSdss commands. ShadowImage - FlashCopy pairs can be established by defining “relationship” using TSO PPRC or DFSMSdss commands. [“Using ShadowImage - FlashCopy”](#) on page 302 describes and provides instructions for using TSOPPRC and DFSMSdss commands to ShadowImage - FlashCopy define relationship.

ShadowImage Requirements

SI390 operations provide disk array-internal copies of S/390 logical volume images (LVIs) on the XP128/XP1024/XP12000. The following table lists and describes the operational requirements for ShadowImage for z/OS.

Table 60 ShadowImage for z/OS requirements

Parameter	Specification
Pair objects	<p>Logical devices (LDEVs): M/F and multiplatform devices that are supported by XP128/XP1024/XP12000, including custom-size devices of Virtual LVI. Devices must be installed and formatted. The S-VOL and T-VOL must be same type and same size. For example, 3390-3R to 3390-3R is allowed, but 3380-K to 3390-9 is not allowed. A custom-size S-VOL must be paired with a T-VOL of the same type and same size. A combination of M/F and multiplatform devices for creating an SI390 pair is supported. Open volumes (for example, OPEN-3, OPEN-9, or OPEN-E) are not supported.</p> <p>Volumes specified as Universal Replicator for Mainframe data volumes or journal volumes cannot be specified as S-VOLs or T-VOLs.</p>
Number of copies	Maximum three copies (T-VOLs) per source volume (S-VOL).
Maximum number of pairs	The total number of SI390, Business Copy (BC), and Auto LUN volume pairs. For details, refer to “Requirements on the Maximum Number of Pairs” on page 234 .
Maximum number of reserved volumes	4,096 reserved volumes per XP128/XP1024/XP12000.
Combinations of RAID levels	All combinations supported: RAID1-RAID1, RAID5-RAID5, RAID1-RAID5, and RAID5-RAID1.
Dynamic sparing and auto correction copy	If a failure occurs that requires use of dynamic sparing or automatic correction copy, the status of the paired volumes associated with the failed physical device will not be affected.
Physical device (PDEV) maintenance	If a PDEV requires maintenance, the status of the logical volumes associated with that PDEV will not be affected. However, if PDEV maintenance requires access to an SI390 pair volume, the pair must be deleted, and the Reserve attribute must be reset (unreserved).
Logical device maintenance	LDEV maintenance cannot be performed on LDEVs that are assigned to SI390 pairs. If LDEV maintenance requires access to an SI390 LDEV, the pair must be deleted, and the Reserve attribute must be reset (unreserved).
Cache maintenance	If XP128/XP1024/XP12000 cache maintenance is performed during a period of high I/O usage, one or more SI390 pairs may be suspended. Reduce the I/O load before cache maintenance.
Point-in-time backup	For duplex pairs, host I/Os are copied to the T-VOL asynchronously. If you want to synchronize a pair and then access the T-VOL as soon as possible, vary the S-VOL offline and then split the pair before using the T-VOL.
Failures	When a failure of any kind prevents an SI390 copy operation from completing, the pair is suspended. If an LDEV failure occurs, the pair is suspended. If a PDEV failure occurs, SI390 pair status is not affected because of the RAID architecture.
Maintenance/Update	When the disk array maintenance is performed, or the microprogram is updated, you may have to add SI390 pairs again.

Requirements on the Maximum Number of Pairs

The number of pairs you can create depends on the emulation type and the capacity of the paired volumes. For details, refer to the following table that shows the number of pairs that can be created with volumes of each emulation type and capacity.

The following table shows the number of pairs that you can create with volumes of same emulation type and capacity. When volumes with different emulation types and capacities are paired, the number of pairs that you can create is determined according to the following condition.

The maximum number of pairs that can be created is the largest number that meets the equation, $\Sigma(\alpha) \leq (\beta)$, where:

$\Sigma(\alpha)$ stands for the total of the number of differential tables per pair, and

(β) stands for the number of differential tables in the disk array.

$(\beta) = 2,048$ when the number of CUs is equal to or less than 4

$(\beta) = 4,096$ when the number of CUs is equal to or more than 5

For example, if you create 10 pairs of 3390-3 volumes and 20 pairs of 3390-L (32,760 CYL) volumes, the total of the number of differential tables per pair, $\Sigma(\alpha)$, would be $(1 \times 10) + (4 \times 20) = 90$.

Because 90 is smaller than 2,048 (when the number of CUs is equal to or less than 4) or 4,096 (when the number of CUs is equal to or more than 5), it meets the equation, $\Sigma(\alpha) \leq (\beta)$, thus ensuring you that 10 pairs of 3390-3 volumes and 20 pairs of 3390-L (32,760 CYL) volumes can be created.

Note that the maximum number of pairs that you can create is limited to the number of volumes that are installed.

Table 61 Number of Pairs That Can Be Created With Volumes of Each Emulation Type and Capacity

Volume			No. of differential tables per pair needed for controlling the difference between the primary and secondary volumes	No. of pairs that can be created (If the volumes of the same emulation type and capacity are used to create all the pairs)	
No.	Emulation Type	Capacity		CUs is 4 or less	CUs is 5 or more
1	3390-3	Does not depend on the capacity	1	2,048	4,096
2	3390-2	Does not depend on the capacity	1	2,048	4,096
3	3390-1	Does not depend on the capacity	1	2,048	4,096
4	3390-9	Does not depend on the capacity	1	2,048	4,096
5	3380-K	Does not depend on the capacity	1	2,048	4,096
6	3380-E	Does not depend on the capacity	1	2,048	4,096
7	3380-J	Does not depend on the capacity	1	2,048	4,096

Table 61 Number of Pairs That Can Be Created With Volumes of Each Emulation Type and Capacity

No.	Volume			No. of differential tables per pair needed for controlling the difference between the primary and secondary volumes	No. of pairs that can be created (If the volumes of the same emulation type and capacity are used to create all the pairs)	
	Emulation Type	Capacity			CUs is 4 or less	CUs is 5 or more
8	3390-L	RAID config. is (2D+2D) or (3D+1P)	RAID config. is (7D+1P)			
9		1 - 10,043 CYL	1 - 10,041 CYL	1	2,048	4,096
10		10,044 - 20,110 CYL	10,042 - 20,109 CYL	2	1,024	2,048
11		20,111 - 30,177 CYL	20,110 - 30,174 CYL	3	682	1,365
12		30,178 CYL or more	30,175 CYL or more	4	512	1,024

ShadowImage Operations

SI390 operations can be performed using the SI390 using the Command View Java applet program for SI390, or from the zSeries and S/390 host using TSO and/or ICKDSF commands. For more information on using TSO/ICKDSF commands to set up and maintain SI390 volume pairs, refer to ["Using PPRC Commands for ShadowImage"](#) on page 284. Your HP representative can also perform SI390 operations for you using the XP128/XP1024/XP12000 service processor (SVP). For information on SI390 configuration services, contact your HP account support representative.

Setting/Resetting Reserve Attribute Operation

The SI390 set reserve attribute operation reserves a volume so that it can be used as an SI390 T-VOL. Reserved volumes can be used only as SI390 T-VOLs. The XP128/XP1024/XP12000 rejects all write operations to reserved volumes (unless in split status). You can reserve up to 4,096 volumes in one XP128/XP1024/XP12000. Use the Set Reserve Attribute window (see ["Setting the Reserve Attribute"](#) on page 266) to reserve volumes for use as T-VOLs.

The SI390 reset reserve attribute operation unreserves a volume so that it can be varied online and accessed by hosts. After you reset the reserve attribute, the XP128/XP1024/XP12000 will accept all subsequent read and write I/O operations to the volume. Use the Reset Reserve Attribute window (see ["Resetting the Reserve Attribute"](#) on page 267) to unreserve volumes.



NOTE: When TSO or ICKDSF commands are used to establish SI390 pairs, the T-VOLs do not need to be reserved. The CESTPAIR and PPRCOPY ESTPAIR commands require that potential T-VOLs be offline to the host.

Add Pair Operation

The SI390 add pair operation establishes the new specified SI390 pair(s). The volume that will be the S-VOL must be in the simplex state, and the volume that will be the T-VOL must be reserved (if assigned automatically) and simplex before being added to an SI390 pair. Use the Add Pair Dialog window (see ["Adding ShadowImage Pairs"](#) on page 268) to add (start) new SI390 volume pairs.



NOTE: Use the CESTPAIR and PPRCOPY ESTPAIR commands to add (start) SI390 pairs. For more information on PPRC commands, see ["Using PPRC Commands for ShadowImage"](#) on page 284.

Initial Copy Operation

During the initial copy process, when you create a volume pair, ShadowImage for z/OS copies data in an S-VOL to a T-VOL. The SI390 initial copy operation takes place when you add a new SI390 pair. The initial copy operation copies all data on the S-VOL to the associated T-VOL(s). The S-VOL remains available to all hosts for read and write I/Os throughout the initial copy operation. Write operations performed on the S-VOL during the initial copy operation will be duplicated at the T-VOL(s) by update copy operations after the initial copy is complete. The status of a pair is *simplex* before the initial copy operation. The status of each pair is *pending* while the initial copy operation is in progress. The pair status changes to *duplex* when the initial copy operation is complete. After initial copy is complete, write operations performed on the S-VOL during the initial copy operation are duplicated at the T-VOL by update copy operations.



NOTE: When adding pairs, you can select the pace for the initial copy operations: slower, medium, or faster. The slower pace minimizes the impact of SI390 operations on disk array I/O performance while the faster pace completes the initial copy operations as quickly as possible.

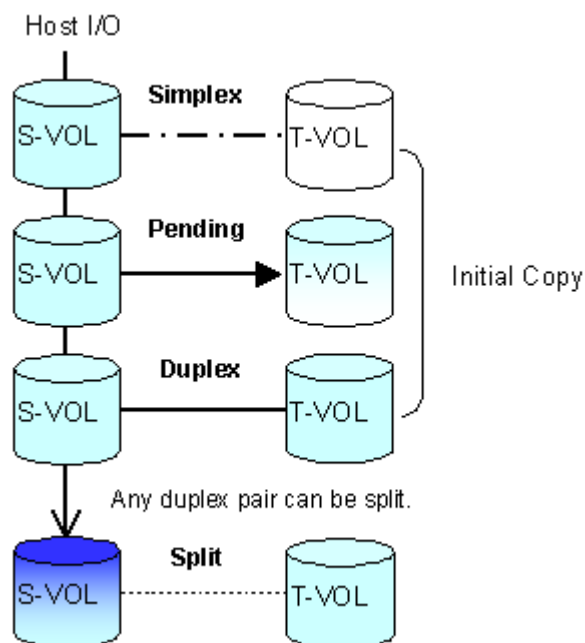


Figure 81 Adding a pair

Update Copy Operation

The SI390 update copy operation updates the T-VOL of an SI390 pair after the initial copy operation is complete. Because an S-VOL remains available to all hosts for read and write I/Os during initial copy, the S-VOL might be updated during the operation. Therefore, when the status of the pair changes to

Duplex after the initial copy operation is complete, the update copy operations take place and the differential data of the S-VOL is copied to the T-VOL. As write I/Os are performed on a duplex S-VOL, the XP128/XP1024/XP12000 stores a map of the S-VOL differential data, and then performs update copy operations periodically based on the amount of differential data present on the S-VOL as well as the elapsed time between update copy operations. The following figure illustrates an update copy operation in an SI390 pair with only one T-VOL.



NOTE: Update copy operations are not performed for SI390 pairs with the following status: *pending*, *SP-pend*, *V-Split*, *split*, *resync*, *resync-R*, and *suspend*.



NOTE: Update copy operations do not occur every time a host issues a write I/O operation to the S-VOL of a zSeries and SI390 pair. Update copy operations are performed asynchronously according to the differential bitmap, which is stored in shared memory. If shared memory is lost (for example, offline micro exchange or volatile PS on), the differential bitmap is also lost. In this case, the XP128/XP1024/XP12000 treats the entire S-VOL (T-VOL for resync-R pairs) as difference data and recopies all data to the T-VOL (S-VOL for resync-R pairs) to ensure proper pair resynchronization. For pairs with SP-pend or V-Split status, the XP128/XP1024/XP12000 changes the status to suspend due to the loss of the differential bitmap, ensuring proper resynchronization of these pairs. If shared memory has been lost, allow extra time for SI390 operations.

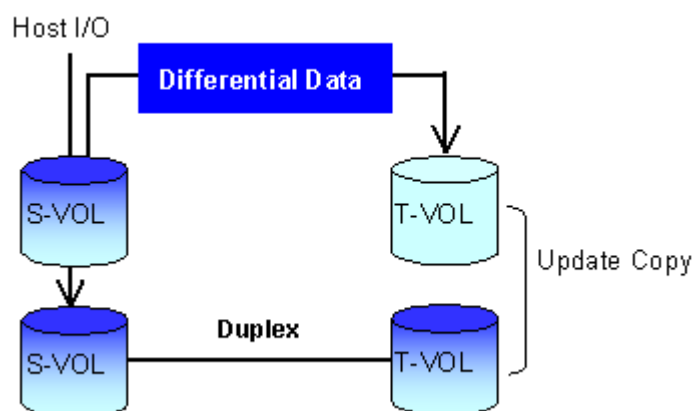


Figure 82 Update Copy operation

Split Pair Operation

The SI390 split capability provides point-in-time backup of your data and also facilitates real data testing by making the SI390 copies (T-VOLs) available for host access. The SI390 split operation performs all pending T-VOL updates (those issued prior to the split command and recorded in the S-VOL track map) to make the T-VOL identical to the state of the S-VOL when the split command was issued. When the split operation is complete, the pair status changes to *split*, and you have full read/write access to the split T-VOL (even though it is still reserved). While the pair is split, the disk array establishes a differential bitmap for the split S-VOL **and** T-VOL, and records all updates to **both** volumes. When a split pair is resynced, the disk array copies all flagged tracks from the S-VOL to the T-VOL. This method ensures that the S-VOL and T-VOL are correctly resynchronized and also reduces the time needed to resynchronize the pair.

Use the Split Volume Pair window (see ["Splitting ShadowImage Pairs"](#) on page 271) to split existing SI390 pairs, or to add and split new SI390 pairs in one step.

- When splitting pairs, you can select the pace for the pending update copy operation(s): **slower**, **medium**, and **faster**. The slower pace minimizes the impact of SI390 operations on disk array I/O performance while the faster pace splits the pairs as quickly as possible.

- When splitting pairs, you can also select the split type: **Quick Split** or **Steady Split**.
 - When the quick split operation starts, the pair status changes to *V-split*, the T-VOL is available immediately for read and write I/Os, and the XP128/XP1024/XP12000 performs all pending update copy operations to the T-VOL in the background. When the quick split operation is complete, the pair status changes to *split* and you have full read/write access to the split T-VOL (even though it is still reserved). The S-VOL also remains fully accessible.
 - When the steady split operation starts, the pair status changes to *SP-pending* and the XP128/XP1024/XP12000 performs all pending update copy operations to the T-VOL. When the steady split operation is complete, the pair status changes to *split* and you have full read/write access to the split T-VOL (even though it is still reserved). The S-VOL also remains fully accessible.

When the pair status changes to *split*, the XP128/XP1024/XP12000 establishes a track map for the split S-VOL **and** T-VOL and records all updates to **both** volumes. Split operations cannot be performed on suspended pairs.



NOTE: Use the CSUSPEND and PPRCOPY SUSPEND commands to split SI390 volume pairs. For more information on using PPRC commands to perform SI390 operations on the XP128/XP1024/XP12000, see [“Using PPRC Commands for ShadowImage”](#) on page 284.

Resynchronize Pair Operations (Normal, Quick, Reverse, Quick Restore)

To change the status of pairs from Split to Duplex or from Suspend to Duplex, you must resynchronize the pairs. ShadowImage performs the following types of resync operations according to the speed and direction of the resynchronization:

- Normal copy
- Quick resync
- Reverse copy
- Quick resync

The Resynchronize Volume Pair pane (see [“Resynchronizing ShadowImage Pairs”](#) on page 273) allows you to resynchronize split and suspended ShadowImage for z/OS pairs. When the resync operation starts, the pair status changes to *resync* or *resyncr*. When the resync is complete, the pair status changes to *duplex*. Command View XP resumes SIz update copy operations after the pair status changes to *duplex*. The S-VOL remains fully accessible during a normal or quick resync operation, but is inaccessible to all hosts during a reverse copy or quick restore operation. This ensures that data on the S-VOL is identical to data on the T-VOL when the reverse copy or quick restore operation completes.



NOTE: You can use ShadowImage for z/OS to perform normal and quick resync operations on split and suspended pairs, but you can perform reverse copy operations only on split pairs.

Forward Pairresync Operation

Forward pairresync operation resynchronizes pairs by copying data on S-VOLs to T-VOLs. The following are the types of forward pairresync operations:

- **Normal.** The normal resync operation (see [Figure 83](#)) resynchronizes the T-VOL with the S-VOL. The copy direction for a normal resync operation is S-VOL to T-VOL. The pair status during a normal resync operation is *resync*, and the S-VOL remains accessible to all hosts for both read and write operations during a normal resync operation. The T-VOL becomes inaccessible to all hosts during a normal resync operation.

- **Quick.** The quick resync operation (see [Figure 83](#)) speeds up the normal resync operation without copying the S-VOL data to the T-VOL. The S-VOL and the T-VOL are resynchronized when update copy operations are performed for duplex pairs. The pair status during a quick resync operation is *resync*, and the S-VOL remains accessible to all hosts for both read and write operations. The T-VOL becomes inaccessible to all hosts during a quick resync operation.

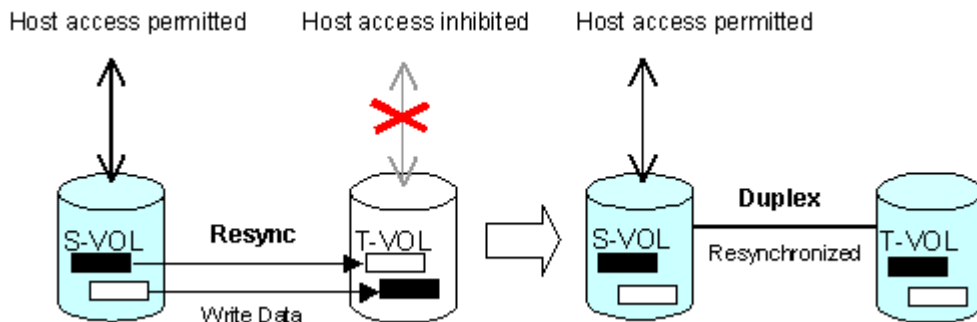


Figure 83 Forward pairresync operations

Backward Pairresync Operation

Backward pairresync operation resynchronizes pairs by copying data on T-VOLs to S-VOLs. The following are the types of the backward pairresync operations:

- **Reverse.** The reverse resync operation (see [Figure 84](#)) synchronizes the S-VOL with the T-VOL. The copy direction for a reverse resync operation is T-VOL to S-VOL. [Table 62](#) on page 240 lists the operational requirements for the reverse resync operation. The pair status during a reverse resync operation is *resync-r*, and the S-VOL and T-VOL become inaccessible to all hosts for write operations during a reverse resync operation. As soon as the reverse resync operation is complete, the S-VOL becomes accessible. The reverse resync operation can be performed only on split pairs, not on suspended pairs.
- **Quick Restore.** The quick restore operation (see [Figure 84](#)) speeds up the reverse resync operation by changing the volume map in the XP128/XP1024/XP12000 to swap the contents of the S-VOL and T-VOL without copying the T-VOL data to the S-VOL. The S-VOL and T-VOL are resynchronized when update copy operations are performed for pairs in the *duplex* status. The pair status during a quick restore operation is *resync-r* until the volume map change is complete. The S-VOL and T-VOL become inaccessible to all hosts for write operations during a quick restore operation. [Table 62](#) on page 240 lists the operational requirements for the quick restore operation.

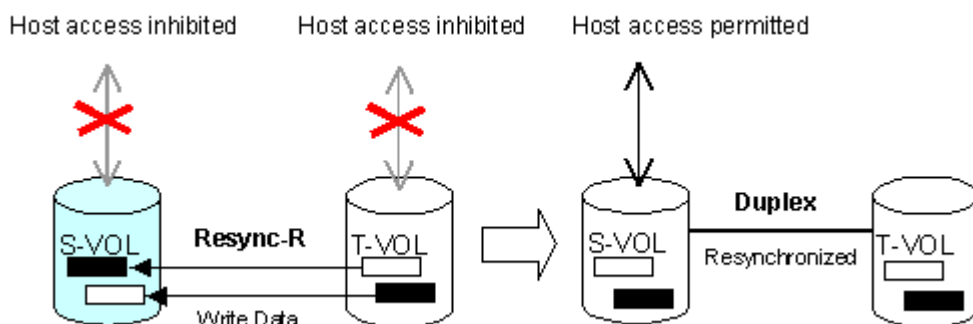


Figure 84 Backward pairresync operations

During the quick restore operation, the RAID levels, Cache LUN XP settings, and HDD types of the S-VOL and T-VOL are exchanged. For example, if the S-VOL has a RAID-1 level and the T-VOL has a RAID-5 level, the quick restore operation changes the RAID level of the S-VOL to RAID-5 and of the T-VOL to RAID-1. To avoid any performance impact due to the quick restore operation:

1. Verify that the S-VOL and T-VOL have the same RAID level and HDD type before performing the quick restore operation. If you want to restore the original RAID levels after quick restore, stop host I/Os to

the pair, split the pair, perform the quick restore operation for that pair again, and then restart the host I/Os to the pair.

2. Because the Cache LUN XP settings are exchanged during a quick restore operation, you must perform one of the two following operations. If you do not, the change of location of the cache residence areas may cause I/O performance to the Cache LUN XP data to be down.
 - a. Set the same Cache LUN XP settings (locations) for the S-VOL and T-VOL before performing the quick restore operation.
 - b. Release the Cache LUN XP settings of the S-VOLs and T-VOLs before the quick restore operation, and then reset the Cache LUN XP settings of the source and target volumes after the pair changes to *duplex* status as a result of the quick restore operation.

If you do not want the S-VOL and T-VOL to be resynchronized after the quick restore operation, you must set the Swap&Freeze option before performing the quick restore operation (see “[Swap&Freeze Option](#)” on page 243 and “[ShadowImage Options](#)” on page 243).

Table 62 Reverse and quick restore Pairresync requirements

Parameter	Requirement(s)
Pair status.	<p>The specified pair must be in the <i>split</i> state. If not, the reverse resync or quick restore command will be rejected.</p> <p>All other pairs that share the same S-VOL as the specified pair must also be in the <i>split</i> or <i>suspended</i> state. If not, the reverse resync or quick restore command will be rejected.</p>
Reverse resync or quick restore command issued to a shared SI390/TC390 volume.	<p>If the SI390 and TC390 pairs share the same volume (S-VOL = M-VOL, T-VOL = M-VOL, or S-VOL = R-VOL), and the TC390 pair is not in the <i>suspend</i> status, the reverse resync and quick restore operations cannot be performed. (The command will be rejected.)</p> <p>During the reverse resync or quick restore operation, a TC390 pair cannot be created. The TC390 add pair command will be rejected when the SI390 pair status is <i>resync-r</i>.</p>
Effect on other pairs that share the S-VOL.	<p>If the reverse resync or quick restore operation is performed on one SI390 pair in a 1-to-n configuration ($n > 1$), the S-VOL and the other T-VOLs are no longer synchronized. While this reverse resync or quick restore is in progress, you cannot perform add, split, or resync pair for any other pair that shares the same S-VOL (delete pair and suspend pair are allowed).</p>
Reverse resync or quick restore ends abnormally. OR Suspend pair is requested during reverse resync or quick restore.	<ol style="list-style-type: none"> 1. The pair status changes to <i>suspended</i>. 2. The S-VOL of the <i>suspended</i> pair is read/write-enabled for all hosts; however, the data on the S-VOL is not guaranteed. The T-VOL of the suspended pair remains read/write-disabled. 3. The status of other SI390 pairs that share the same S-VOL does not change.
Reverse copy or quick restore command issues to a shared SIz/Universal Replicator volume.	<p>If the ShadowImage and Universal Replicator for z/OS pairs share the same volume, and the Universal Replicator pair is not in the <i>suspend</i> status, the reverse copy and a quick restore operations cannot be performed.</p>



CAUTION: When a reverse or quick restore resync operation ends abnormally or a Suspend pair is requested during a reverse copy or quick restore, the pair status changes to suspended. The suspended pair's S-VOL is read/write-enabled for all hosts; however, data on the S-VOL is not guaranteed. The suspended pair's T-VOL remains read/write-disabled.

Even when a reverse or quick restore resync operation ends abnormally or a Suspend pair is requested during a reverse copy or quick restore, the status of other ShadowImage for z/OS pairs sharing the same S-VOL does not change.

If the reverse copy or quick restore operation is performed on one ShadowImage for z/OS pair in a 1-to-n configuration ($n > 1$), the S-VOL and the other T-VOLs are no longer synchronized.



NOTE: During reverse copy or quick restore operation, you cannot perform add, split, or resync pair for any other pair that shares the same S-VOL (delete pair and suspend pair are allowed).

Pair Status and the Time Required for Pairresync

The pairresync operation can be performed on a split pair or a suspended pair. This section describes the relationship between pair status and time required for pairresync operations.

- **Resync for split pair.** When a normal/quick resync operation is performed on a split pair, the XP128/XP1024/XP12000 copies all differential data from the S-VOL to the T-VOL. When a reverse resync or quick restore operation is performed on a split pair, the disk array copies all differential data from the T-VOL to the S-VOL. This ensures that the S-VOL and T-VOL are properly resynchronized in the appropriate direction, and also greatly reduces the time needed to resynchronize the pair.
- **Resync for suspended pair.** When a normal/quick resync operation is performed on a suspended pair, the XP128/XP1024/XP12000 copies all data on the S-VOL to the T-VOL because all S-VOL tracks were flagged as difference data when the pair was suspended. Reverse pairresync and quick restore operations cannot be performed on suspended pairs. The normal resync operation for suspended pairs is equivalent to and takes as long as the SI390 initial copy operation.



CAUTION: When resynchronizing pairs, you can select the pace for the resync operations: slower, medium, and faster. The slower pace minimizes the impact of ShadowImage for z/OS operations on subsystem I/O performance, while the faster pace resynchronizes the pairs as quickly as possible. The quick resync option provides the fastest normal resync operation, but it may affect subsystem I/O performance.

Use the Resynchronize Volume Pair window (see "[Resynchronizing ShadowImage Pairs](#)" on page 273) to resynchronize split and suspended SI390 pairs. When the resync operation starts, the pair status changes to *resync* or *resync-r*. When the resync is complete, the pair status changes to *duplex*. The XP128/XP1024/XP12000 resumes SI390 update copy operations after the pair status changes to *duplex*. The S-VOL remains fully accessible during a normal/quick resync operation, but becomes inaccessible to all hosts during a reverse resync or quick restore operation. This ensures that the data on the S-VOL is identical to the data on the T-VOL when the reverse resync or quick restore operation completes.

When resynchronizing pairs, you can select the pace for the resync operation(s): slower, medium, and faster. The slower pace minimizes the impact of SI390 operations on disk array I/O performance, while the faster pace resynchronizes the pair(s) as quickly as possible. The quick resync option provides the fastest normal resync operation.



NOTE: Use the CESTPAIR and PPRCOPY ESTPAIR commands to resynchronize split SI390 volume pairs. For more information on using PPRC commands to perform SI390 operations on the XP128/XP1024/XP12000, see ["Using PPRC Commands for ShadowImage"](#) on page 284.

After an SI390 reverse resync or quick restore operation is performed, verify that the pair status changes to duplex before performing a TC390 resume pair operation. If you perform the TC390 resume pair operation before the pair status changes to duplex, the command (resume pair operation) will be rejected.

Suspend Pair Operation

The SI390 suspend pair operation suspends the update copy operations to the T-VOL of the pair. An SI390 pair can be suspended by the user at any time. When an SI390 pair is suspended, the XP128/XP1024/XP12000 stops performing update copy operations to the T-VOL, continues accepting write I/O operations to the S-VOL, and marks the entire S-VOL track as difference data. When a resync operation is performed on a suspended pair, the entire S-VOL is copied to the T-VOL. Reverse resync and quick restore cannot be performed on suspended pairs. While the resync operation for a split pair can be very fast, the resync operation for a suspended pair will take as long as the initial copy operation.

The XP128/XP1024/XP12000 will automatically suspend an SI390 pair when it cannot keep the pair mirrored for any reason. When the XP128/XP1024/XP12000 suspends a pair, sense information is generated to notify the host. The XP128/XP1024/XP12000 will automatically suspend an SI390 pair under the following conditions:

- When the XP128/XP1024/XP12000 detects an error condition related to an update copy operation.
- When the S-VOL and/or T-VOL track map in shared memory is lost (for example, due to offline microprogram exchange). This applies to *SP-pend* and *V-split* pairs only. For *duplex*, *split*, *resync*, or *resync-r* pairs, the pair is not suspended but the entire S-VOL (T-VOL for reverse resync) is marked as difference data.

Use the Suspend Volume Pair window (see ["Suspending ShadowImage Pairs"](#) on page 275) to suspend SI390 pairs. When a pair is suspended, the pair status changes to *suspended*. When the resync operation starts, the pair status changes to *resync*. The S-VOL remains fully accessible while suspended and during the resync operation. Use the Resynchronize Volume Pair window (see ["Resynchronizing ShadowImage Pairs"](#) on page 273) to resynchronize suspended SI390 pairs.



NOTE: The PPRC commands do not support the SI390 suspend operation. You must use the SI390 remote console software to suspend SI390 pairs. The CSUSPEND and PPRCOPY SUSPEND commands execute an SI390 split operation instead of a suspend operation. For more information on using PPRC commands to perform SI390 operations on the XP128/XP1024/XP12000, see ["Using PPRC Commands for ShadowImage"](#) on page 284.

Delete Pair Operation

The SI390 delete pair operation stops the SI390 update copy operations to the T-VOL of the pair and changes the pair status of both volumes to *simplex*. An SI390 pair can be deleted by the user at any time except during the quick split operation (that is, any status except *simplex* and *V-split*). After you delete an SI390 pair, the T-VOL is still not available for write operations until the reserve attribute is reset.

Use the Delete Volume Pair window (see ["Deleting ShadowImage Pairs"](#) on page 277) to delete SI390 pairs. When an SI390 pair is deleted, pending update copy operations for the pair are discarded, and the status of the S-VOL and T-VOL is changed to *simplex*.



CAUTION: The T-VOL of a duplex pair may not be identical to its S-VOL, due to the asynchronous SI390 update copy operations. To synchronize the volumes before deleting the pair, you must split the pair first (see ["Deleting ShadowImage Pairs"](#) on page 277 for instructions).

ShadowImage Options

By using the SI390 options, you can extend the standard SI390 operations such as the add pair and resync pair operations. The following table shows the options that are currently available.

Table 63 Types of ShadowImage options

No.	Option Type	Requirement
1	Swap&Freeze	The SI390 quick restore operation can be performed on the XP128/XP1024/XP12000. If the XP128/XP1024/XP12000 setting disables the quick restore operation, you must change the setting to use the Swap&Freeze option. Refer to "Swap&Freeze Option" on page 243.
2	Host I/O Performance	Refer to "Host I/O Performance Option" on page 244.
2 - 32	Reserved (Currently unavailable.)	-



NOTE: Available option types depend on the XP128/XP1024/XP12000 settings.

Swap&Freeze Option

The Swap&Freeze option allows the S-VOLs of an SI390 pair to remain unchanged after the quick restore operation. If the quick restore operation is performed on an SI390 pair with the Swap&Freeze option, update copy operations are suppressed, and thus are not performed for pairs in the duplex status after the quick restore operation. If the quick restore operation is performed without the Swap&Freeze option, the S-VOL and T-VOL are resynchronized when update copy operations are performed for pairs in the duplex status.



NOTE: Verify that the Swap&Freeze option remains in effect until the pair status becomes duplex after the quick restore operation.

The following figure shows the state of the T-VOL after the quick restore operation with or without the Swap&Freeze option.

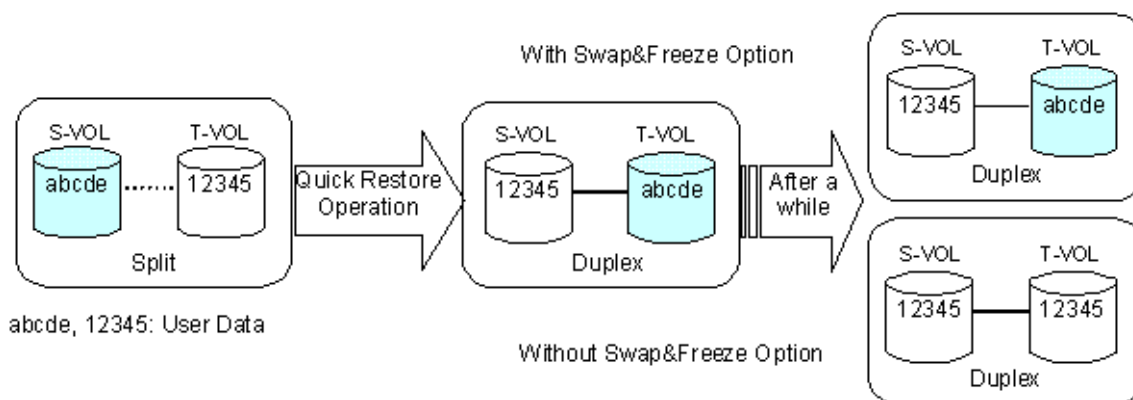


Figure 85 Quick Restore operation with or without Swap&Freeze option

The Quick Restore pairresync operation on a pair with split status exchanges data in the pair's S-VOL and T-VOL. If you use the Swap&Freeze option when performing the Quick Restore pairresync operation, the update copy operation does not take place after the Quick Restore pairresync operation is complete. Therefore, data on the S-VOL and T-VOL is kept exchanged. If you do not use the Swap&Freeze option when performing the Quick Restore pairresync operation, the update copy operation takes place after the Quick Restore pairresync operation is complete, and data on the S-VOL overwrites the T-VOL.

Host I/O Performance Option

The Host I/O Performance option improves host I/O responses over SI390 copying processing time. When the Host I/O Performance option is used, the disk array suppresses execution of SI390 copying processing, and consequently the host I/O responses improve.

When SI390 copying processing is suppressed by the Host I/O Performance option, the time taken for copying increases. Also, if BC pairs exist, host I/O responses might not be faster. In this case, set the Host I/O Performance option for BC as well.

At-Time Split Function

If the XP disk array has firmware version 21.06.22 or later installed, you can take advantage of the SI390 At-Time Split function, which can be applied to SI390 pairs that belong to a consistency group. This function copies data from S-VOL into T-VOL at the Split time you specify by executing the ATSPILT command to one or more SI390 pairs belonging to the same consistency group.

A SI390 consistency group is a user-defined set of SI390 volume pairs used for the At-Time Split function and have the following restrictions:

- You can configure up to 128 consistency groups in a disk array, including the BC consistency groups.
- A number (0-127) is assigned to each consistency group. You can specify a consistency group number when you create SI390 pairs.
- You can view the ID of the consistency groups used as the pair unit using Command View or by executing the ATQUERY command.
- You can define up to 1,024 SI390 pairs in a consistency group.

- SI390 pairs and BC pairs cannot co-exist in the same consistency group.

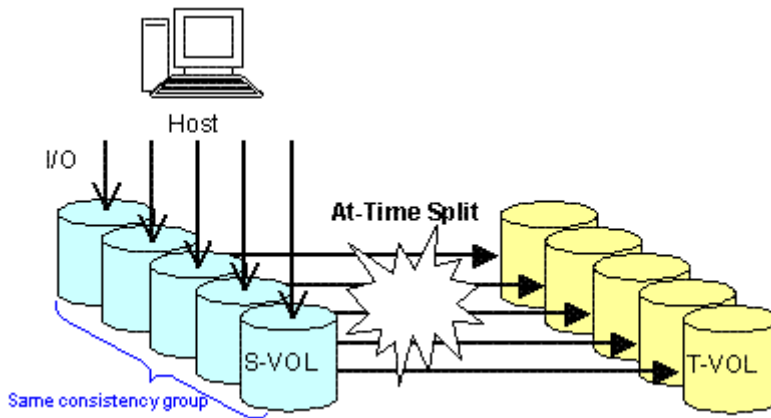


Figure 86 Outline of the At-Time Split function

The SI390 At-Time Split function can be used only by executing the PPRC TSO commands.

To use the SI390 At-Time Split function by executing the PPRC TSO commands:

1. Specify the ID of the consistency group you intend to use with Command View.
2. Use the TSO ESTPAIR command to create a pair by specifying the ID of the consistency group you intend to use in this command.
3. Use the ATSPILT command to specify the ID of the consistency group and the time to execute the Split operation. By executing the ATSPILT command, the Split time you specified will be registered.
4. After the Split time specified in the ATSPILT command has passed, use the ATQUERY command to confirm that the pairs in the consistency group specified in the ATQUERY command have all changed their status to Split.
5. Specify the parameter CANCEL in the ATSPILT command. By executing the ATSPILT command where you specified the parameter CANCEL, the Split time that you have registered will be reset.

For more information about using the ATSPILT command, see ["Setting and Resetting the At-Time Split Time: ATSPILT"](#) on page 300. For details on the method of using the ATQUERY command, see ["Displaying the Status of the Consistency Group: ATQUERY"](#) on page 301.

When you execute the ATSPILT command, confirm beforehand that the status of all the pairs in the consistency group that you specified is either Pending or Duplex, or the ATSPILT command will be rejected.

If you execute the ATSPILT command more than once, the ATSPILT command you have executed last is the one that is valid.

You can perform operations for the pairs in the consistency group to which you registered the Split time only when the pairs are in the Delete Pair or Suspend status. If you perform an Add Pair, Split, or Pair Resync operation, the ATSPILT command will be rejected. To perform an Add Pair, Split, or Pair Resync operation, you must first reset the registration of the Split time by executing the ATSPILT command in which you specified the CANCEL parameter.

When you execute the ATSPILT command, confirm beforehand that no S-VOL in the consistency group you specified is used as a TC390 R-VOL, or the ATSPILT command will be rejected.

Confirm beforehand that the timer of the host that issues the ATSPILT command is correctly set. If not, the data copied to the T-VOL after the Split operation cannot be guaranteed to be the same as the data stored in the S-VOL at the time specified by the ATSPILT command you have executed last.

The Split time that you set by executing the ATSPILT command will be reset by executing PS OFF.

ShadowImage Pair Status

The SI390 remote Command View Java applet program displays the SI390 pair status of all S/390 volumes under the specified CU image of the connected XP128/XP1024/XP12000. Figure 87 illustrates the pair status transitions and the relationship between the pair status and the SI390 operations.

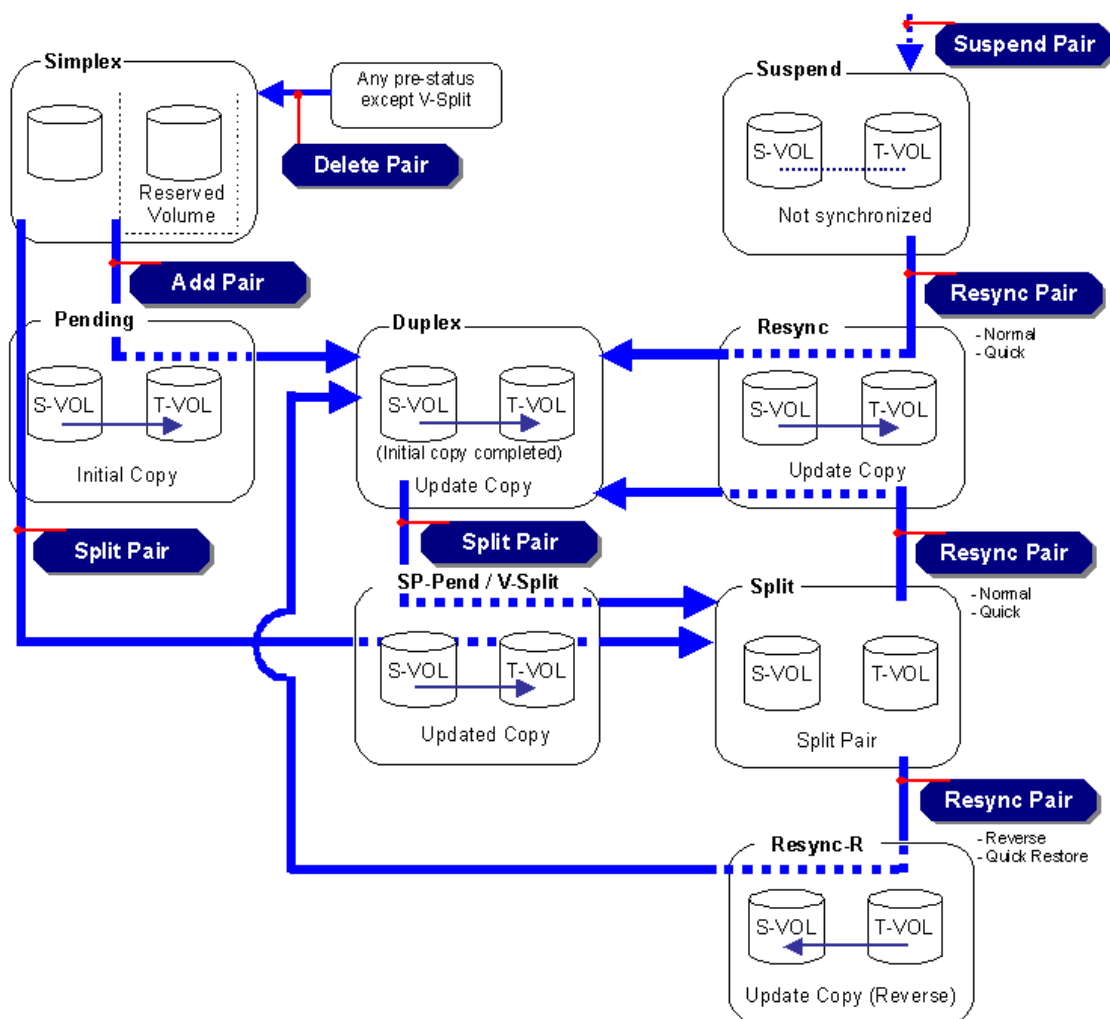


Figure 87 ShadowImage pair status transitions

1. If a volume is not assigned to a ShadowImage for z/OS (SIz) pair, its status is simplex.
2. Select the simplex volumes for S-VOL and T-VOL to create an SIz pair. When you create an SIz pair, the initial copy operation starts. During the initial copy operation, the status of the S-VOL and T-VOL changes to pending.
3. When the initial copy operation is complete, the pair status becomes duplex. When the pair status is duplex, its S-VOL and T-VOL have the same data. If the S-VOL is updated after the initial copy operation, the update copy operation takes place and synchronizes S-VOL and T-VOL.
4. There are two kinds of pair status (split and suspend) when the pair is not synchronized.
 - When you split a pair (pairsplit), the pair status changes to split. During the pairsplit process, the pair status becomes SP-pending. Note that if you specify Quick Split pairsplit, the pair status becomes V-Split during the process. When the split is complete, the pair status changes to split, and you can access the split T-VOL. The update copy operation is not performed on the pairs with split status.
 - If the XP128/XP1024/XP12000 cannot maintain duplex status for any reason or if you suspend the pair, the pair status changes to suspend.

5. When you start a pairresync operation, the pair status changes to resync or resync-r. When the pairresync operation is complete, the pair status changes to PAIR.



NOTE: When you specify reverse or quick restore mode for a pairresync operation, the pair status changes to resync-r (data is copied in the reverse direction from the T-VOL to the S-VOL). For more information about pairresync operation settings, see ["Resynchronizing ShadowImage Pairs"](#) on page 273.

When you delete a pair, the pair status changes to simplex. You cannot delete the pair with status V-Split.

Table 64 shows the allowable operations for each pair status. Table 65 lists and describes the SI390 pair status conditions.

Table 64 Pair status versus allowable operations

Operation	Pair Status								
	Simpl.	Pend.	Duplex	SP-Pend	V-Split	Split	Resync	Resync-R	Susp.
Add Pair	OK	OK	OK	x	x	x	x	x	x
Split Pair	OK	OK	OK	x	x	x	x	x	x
Suspend Pair	x	OK	OK	OK	OK	OK	OK	OK	x
Resync Pair	x	x	x	x	OK	OK	x	x	OK
Reverse Resync Quick Restore	x	x	x	x	x	OK	x	x	x
Delete Pair	x	OK	OK	OK	x	OK	OK	OK	OK

Table 65 ShadowImage for z/OS pair status

Status	Description	Host Status	S-VOL Access	T-VOL Access
Simplex	The volume is not assigned to an SI390 pair. The XP128/XP1024/XP12000 accepts read and write I/Os for all <i>simplex</i> volumes that are not reserved.	S-VOL = SIMPLEX T-VOL = SIMPLEX	N/A There is no S-VOL yet.	N/A If the volume is reserved as a T-VOL, the disk array does not accept read and write I/Os.
Pending	The initial copy operation is in progress. The XP128/XP1024/XP12000 continues to accept read and write operations for the S-VOL, but stops accepting writes for the T-VOL. No update copy operations are performed.	S-VOL = PPRI-PNDG T-VOL = PSEC-PNDG	Read/write.	Read/write disabled.

Table 65 ShadowImage for z/OS pair status (continued)

Status	Description	Host Status	S-VOL Access	T-VOL Access
Duplex	The initial copy operation is complete and the XP128/XP1024/XP12000 starts performing asynchronous update copy operations from the S-VOL to the T-VOL as needed. The S-VOL and T-VOL of a duplex pair may not be identical. The XP128/XP1024/XP12000 rejects all write I/Os for T-VOLs with the status <i>duplex</i> .	S-VOL = PPRIMARY T-VOL = PSECONDRY	Read/write.	Read/write disabled.
SP-Pend	The status becomes <i>SP-Pend</i> when the Steady Split mode is selected for the split operation. All S-VOL updates prior to the split command are being copied to the T-VOL. When these updates are complete, the split T-VOL is identical to the state of the S-VOL when the split started. The XP128/XP1024/XP12000 rejects writes for <i>SP-Pend</i> T-VOLs.	S-VOL = PPRI-PNDG T-VOL = PSEC-PNDG	Read/write.	Read/write disabled.
V-Split	The status becomes <i>V-Split</i> when the Quick Split mode is selected for the split operation. Only the S-VOL differential data is being copied to the T-VOL in background. The XP128/XP1024/XP12000 accepts writes for <i>V-Split</i> T-VOLs. The <i>V-Split</i> pairs cannot be deleted.	S-VOL = PPRI-SUSP T-VOL = SIMPLEX	Read/write.	Read/write, can be varied online.
Split	The XP128/XP1024/XP12000 stops performing update copy operations for split pairs and starts accepting write I/Os for split T-VOLs. The XP128/XP1024/XP12000 keeps track of all updates to the split S-VOL and T-VOL so the pair can be resynced accurately and quickly.	S-VOL = PPRI-SUSP T-VOL = SIMPLEX	Read/write.	Read/write, can be varied online.
Resync	The XP128/XP1024/XP12000 does not accept write I/Os for <i>resync</i> T-VOLs. When a split pair is resynchronized in normal mode, only the S-VOL differential data is copied to the T-VOL. When a suspended pair is resynchronized, the entire S-VOL is copied to the T-VOL. No update copy operations are performed during <i>resync</i> operation.	S-VOL = PPRI-PNDG T-VOL = PSEC-PNDG	Read/write.	Read/write disabled.

Table 65 ShadowImage for z/OS pair status (continued)

Status	Description	Host Status	S-VOL Access	T-VOL Access
Resync-R	The XP128/XP1024/XP12000 does not accept write I/Os for <i>resync-r</i> T-VOLs or S-VOLs. When a split pair is reverse resynchronized, the XP128/XP1024/XP12000 copies only the T-VOL differential data to the S-VOL. The reverse resync cannot be performed on suspended pairs. No update copy operations are performed during reverse resync or quick restore.	S-VOL = PPRI-PNDG T-VOL = PSEC-PNDG	Read/write disabled.	Read/write disabled.
Suspend	The XP128/XP1024/XP12000 does not perform update copy operations to a suspended T-VOL. The XP128/XP1024/XP12000 marks the entire S-VOL track map as differential data so the entire S-VOL is copied to the T-VOL when the pair is resumed. Use resync command to resume a suspended pair. Reverse resync and quick restore cannot be used to resume suspended pairs.	S-VOL = PPRI-SUSP T-VOL = PSEC-SUSP	Read/write.	Read/write disabled.

Cautions on Switching Off the Power Supply

If you need to switch off the power supply of the disk array during SI390 operations, make sure to:

- Complete copying for the SI390 pair in the SP-pend status first to change the pair status from SP-pend to split, and then switch off the power supply. If the shared memory is volatilized when you switch on the power supply again, the pair in the SP-pend status changes to suspend.
- Establish a timetable for SI390 copying operations. If the shared memory is volatilized when you switch on the power supply again, the following conditions occur:
 - If the SI390 pair was in the pending or resync status, data that was already copied becomes the target data to be copied after the power supply is turned back on. Even if there is no host I/O, the data consistency rate does not reach 100% when the SI390 pair status changes to duplex. When the SI390 pair status changes to duplex, the target data is copied to the T-VOL.
 - If the SI390 pair was in the duplex status, data that was already copied becomes the target data to be copied after the power supply is turned back on. In this case, the data consistency rate is 0%, and the target data is copied to the T-VOL.
 - If the SI390 pair was in the split status, the entire volume becomes the differential data. In this case, the data consistency rate is 0%, and the entire volume is copied to the T-VOL when you perform the resync pair operation.

Preparing for ShadowImage Operations

System Requirements

SI390 operations involve the XP128/XP1024/XP12000 containing the S-VOLs and T-VOLs, the SI390 feature enabled on the Command View management station, and (optional) S/390 host PPRC software functions. The SI390 system requirements are:

- XP128/XP1024/XP12000. All XP128/XP1024/XP12000 hardware, microcode, and software required for SI390 operations must be installed and enabled.
- Command View management station (user-supplied Windows-based PC).



NOTE: You must operate the Command View management station in Modify mode to perform SI390 operations. Users in view mode can only view SI390 information.

- SI390 feature license key installed.

Preparing for ShadowImage Operations

To ensure that the XP128/XP1024/XP12000 is ready for SI390 operations, perform the following tasks:

- SI390 operations affect the I/O performance of the XP128/XP1024/XP12000 because of the additional write operations to the T-VOLs. If you have not already done so, you should consider the relative importance of the disk array's I/O performance and the backup SI390 copies. For example, assigning three T-VOLs to each S-VOL takes more resources than assigning only one or two. You can also use the SI390 copy pace option to reduce the impact of the SI390 initial copy operations. Using a slower copy pace minimizes the impact of zSeries and SI390 operations on I/O performance, while a faster copy pace produces point-in-time copies more quickly but may affect I/O performance. The SI390 initial copy operation is performed only once to each T-VOL (unless the pair is suspended).
- Identify the volumes (LDEVs) that will be the SI390 volumes. For each volume, write down the CU image and LDEV ID, whether the volume will be an S-VOL or T-VOL, and the other volume(s) in its pair (see [Table 66](#) on page 250 for a sample table). The S-VOLs will remain fully accessible to all hosts throughout normal SI390 operations (except during reverse resync and quick restore). The T-VOLs will need to be varied offline before being reserved for SI390 operations. After assigned to a pair, a T-VOL rejects all write I/Os, except when the pair is split.
- SI390 and TC390 can function together in the same XP128/XP1024/XP12000 to provide both internal and remote backup for your important data. If you are planning to combine SI390 and TC390, read the important configuration information in ["Combining ShadowImage and TrueCopy Operations"](#) on page 252.

Table 66 Sample table for ShadowImage configuration information

CU #	LDEV	S-VOL?	Associated T-VOL(s)	T-VOL?	Associated S-VOL
0	00	Yes	0:10, 0:11	No	--
0	01	Yes	0:12, 0:13	No	--
etc.	...	...	...	...	...
0	0F	Yes	0:2E, 0:2F	No	--
0	10	No	--	Yes	0:00

Table 66 Sample table for ShadowImage configuration information (continued)

CU #	LDEV	S-VOL?	Associated T-VOL(s)	T-VOL?	Associated S-VOL
0	11	No	–	Yes	0:00
0	12	No	–	Yes	0:01
etc.	...	...	...	...	...

Combining ShadowImage with Other Data Management Operations

SI390 supports concurrent operations with the following data management functions:

- **Virtual LVI/LUN.** Virtual LVI/LUN volumes can be assigned to SI390 pairs provided that the T-VOL has the same capacity as the S-VOL. If you need to perform Virtual LVI/LUN operations on an existing SI390 S-VOL or T-VOL, you must delete the pair first to return the volume to *simplex* status.
- **Cache LUN XP.** Cache LUN XP volumes can be assigned to SI390 pairs, and Cache LUN XP operations can be performed on existing SI390 S-VOLs and T-VOLs.



CAUTION: For important information on performing quick restore operations on Cache LUN XP volumes, see [“Resynchronize Pair Operations \(Normal, Quick, Reverse, Quick Restore\)”](#) on page 238.

- **TCz.** TCz volumes can be assigned to SIz pairs and SIz volumes can be assigned to TCz pairs. For important information on SI390 and TC390 shared volume configurations, refer to [“Combining ShadowImage and TrueCopy Operations”](#) on page 252.



NOTE: SI390 is recommended for intra-disk array copy operations. If SI390 is not installed, TC390 (synchronous only) can be used to copy within the same XP128/XP1024/XP12000. This TC390 configuration requires at least one external Fibre Channel interface cable loop (minimum of two is recommended).

- **HXRC.** If SI390 S-VOLs and HXRC source volume (original data) share the same volumes, you cannot perform the reverse resync or quick restore operation for those volumes. Do not use HXRC target volumes (copied data) for SI390 volumes.
- **HP Auto LUN.** SI390 volumes can be assigned to migration volumes of HP Auto LUN. However, if the SI390 S-VOL is already paired with three T-VOLs, you must delete the SI390 pairs before migrating the volumes by using Auto LUN. Also, if you want to assign SI390 volumes to destination volumes of migration by using Auto LUN, or reserve SI390 volumes for Auto LUN, you must delete the SI390 volumes or unreserve SI390 volumes before using the volumes. If you assign an SI390 S-VOL that is already paired with three T-VOLs to migration volumes of Auto LUN or assign SI390 volumes to other Auto LUN volumes than migration volumes, the command will be rejected.

Also, if you split the SI390 pair that is assigned to Auto LUN migration volumes, migration of those volumes will be canceled.



NOTE: You cannot use migration volumes, destination volumes, and reserved volumes of Auto LUN for SI390 pair operations because the command will be rejected. If you want to use Auto LUN volumes for SI390 pair operations, you must release the volumes by using Auto LUN.

- **SANtinel - S/390.** SANtinel operations do not directly affect SI390 operations. Secure LDEVs can be assigned to SI390 pairs, and SI390 volumes can be secured. A secure LDEV will accept SI390 initial and update copy operations. When an S-VOL is secured by SANtinel, this setting does not apply to the corresponding T-VOLs. SANtinel T-VOLs cannot be accessed by any host except when the pair is split.

Combining ShadowImage and TrueCopy Operations

SI390 and TC390 can function together in the same XP128/XP1024/XP12000 to provide both internal and remote backup for your important data.

- When SI390 and TC390 pairs share the same volume, to obtain the SI390 pair status, query from the host:
 - The T-VOL status of the SI390 pair if the SI390 S-VOL and TC390 M-VOL share the same volume.
 - The T-VOL status of the SI390 pair if the SI390 S-VOL and TC390 R-VOL share the same volume.
 - The S-VOL status of the SI390 pair if the SI390 T-VOL and TC390 M-VOL share the same volume.
- SI390 supports multiple T-VOLs for each S-VOL. If you issue a pair status query to an SI390 S-VOL, the status for only one SI390 pair is reported (the pair with the T-VOL with the lowest LDEV ID). To obtain the pair status for the SI390 pair(s) with the other T-VOL(s), you must direct the host query to the specific T-VOL using the T-VOL's LDEV ID in the host command. The SI390 remote console software displays the LDEV ID and SI390 pair status of all T-VOLs associated with an S-VOL.
- Reverse resync and quick restore operations can be performed on shared SI390/TC390 pairs only when the TC390 pair is suspended.

Table 67 describes the host pair status reporting for SIz, URz volumes, and SIz/URz shared volumes; and SI390 volumes, Universal Replicator for z/OS volumes, and ShadowImage and Universal Replicator for z/OS shared volumes. Table 68 lists the currency of the data on shared SI390/URz volumes based on the SI390 and URz pair status.

Table 67 Host pair status reporting for SI390/TC390 shared volumes

Number of SI390 S-VOLs	Number of TC390 Pairs	Pair Status Reported by XP128/XP1024/XP12000
0	0	Simplex
1	0	SI390 pair status
2 or more	0	SI390 pair status for the pair whose T-VOL has the lowest LDEV ID
0	1	TC390 pair status
1	1	TC390 pair status
2 or more	1	TC390 pair status

Table 68 Currency of a shared SI390 and TC390 volume

	TC390 Pair Status		
SI390 Pair Status	Pending	Duplex	Suspended
Pending	Not current	Not current	Not current
Duplex	Not current	Not current	CURRENT

Table 68 Currency of a shared SI390 and TC390 volume (continued)

	TC390 Pair Status		
SI390 Pair Status	Pending	Duplex	Suspended
SP-Pending	Not current	Not current	CURRENT
V-Split	Not current	Not current	CURRENT
Split	CURRENT	CURRENT	CURRENT
Resync	Not current	Not current	CURRENT
Resync-r	-	-	CURRENT
Suspended	Not current	Not current	Not current

The configuration shown in the following figure is an example of a volume that is functioning as both an SI390 S-VOL and a TC390 M-VOL. With this configuration, you can:

- Use SI390 to provide on-site backup copies of TC390 M-VOLs.
- Use TC390 to provide remote backup copies of SI390 S-VOLs.

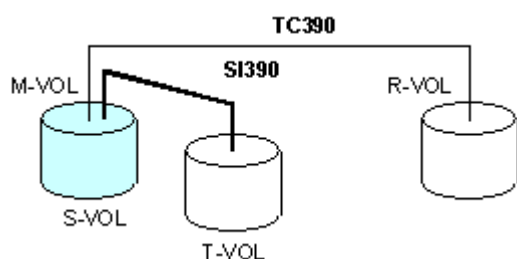


Figure 88 SI390 and TC390: shared S-VOL/M-VOL

The configuration shown in the following figure is an example of a volume that is functioning as both an SI390 S-VOL and a TC390 R-VOL. With this configuration, you can use SI390 to provide additional remote copies of TC390 M-VOLs.

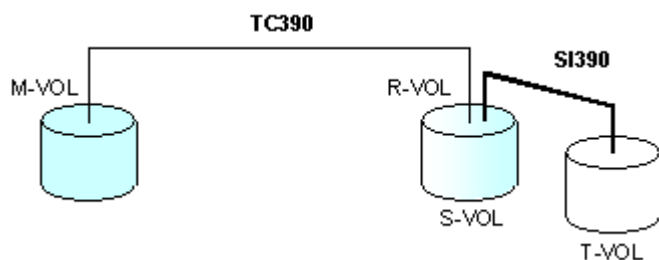


Figure 89 SI390 and TC390: shared S-VOL/R-VOL

The configuration shown in the following figure is an example of a volume that is functioning as both a TC390 M-VOL and an SI390 S-VOL, while the R-VOL of the same TC390 pair is also functioning as the S-VOL of another SI390 pair. With this configuration, you can:

- Use SI390 to provide on-site backup copies of TC390 M-VOLs and R-VOLs.

- Use TC390 to provide remote backup of SI390 S-VOLs.

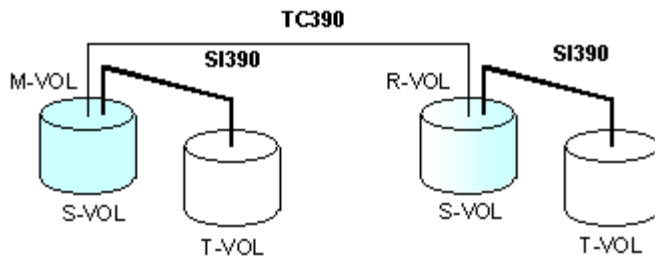


Figure 90 SI390 and TC390: shared S-VOL/M-VOL and S-VOL/R-VOL

The configuration shown in the following figure is an example of a volume functioning as both an SI390 T-VOL and a TC390 M-VOL.



NOTE: This configuration does not allow SI390 and TC390 to copy at the same time. Add the SI390 pair first, and then split the pair before creating the TC390 pair. You must suspend the TC390 pair to resync the SI390 pair. The TC390 pair status cannot be changed when the SI390 pair is in the V-Split status.

You cannot distinguish the Split status from the V-Split status with the PPRC command. When you use the SI390 and TC390 shared configuration shown in the following figure, you must either use the PPRC command to perform the Steady Split operation or use the Remote Console PC to confirm the pair statuses. You can perform the Steady Split operation by specifying the CSUSPEND parameters (Byte 7 = 'M', Byte 8 = 'P', Byte 9 = 'S'). For details about the PPRC commands, refer to ["Using PPRC Commands for ShadowImage"](#) on page 284.

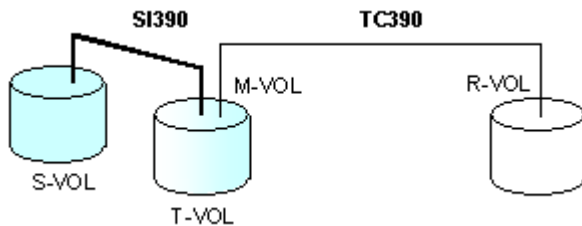


Figure 91 SI390 and TC390: shared T-VOL/M-VOL

Combining ShadowImage for z/OS (SIz) with Universal Replicator for z/OS (URz)

URz volumes can be assigned to SIz pairs, and SIz volumes can be assigned to URz pairs.



NOTE: A Universal Replicator for z/OS primary volume (P-VOL) means a primary data volume of Universal Replicator for z/OS. A Universal Replicator for z/OS secondary volume (S-VOL) means a secondary data volume of Universal Replicator for z/OS.



NOTE: SI390 is recommended for intra-disk array copy operations. If ShadowImage for z/OS is not installed, Universal Replicator for z/OS (synchronous only) can be used to copy within the same local disk array. This URz configuration requires at least one Fibre Channel interface cable loop (minimum of two is recommended).

ShadowImage for z/OS and Universal Replicator for z/OS can function together in the same local disk array to provide both internal and remote backup for important data.

To query the status of an Slz pair when Slz and Universal Replicator for z/OS pairs share the same volume, do the following:

- Query the Slz T-VOL status from the host if the Slz S-VOL and URz P-VOL share the same volume
- Query the Slz T-VOL status from the host if the Slz S-VOL and URz S-VOL share the same volume

ShadowImage for z/OS supports multiple T-VOLs for each S-VOL. If you issue a pair status query to an Slz S-VOL, the status for only one Slz pair is reported (the pair with the T-VOL having the lowest LDEV ID). To obtain the pair status for the Slz pairs with the other T-VOLs, direct the host query to the specific T-VOL using the T-VOL's LDEV ID in the host command. The Slz remote console software displays the LDEV ID and Slz pair status of all T-VOLs associated with an S-VOL.

Table 69 describes the host pair status reporting for Slz, URz volumes, and Slz/URz shared volumes. Table 70 lists the currency of the data on shared Slz/URz volumes based on the Slz and URz pair status.

Table 69 Host pair status reporting for Slz/URz shared volumes

Number of Slz S-VOLs	Number of URz Pairs	Pair Status Reported by XP128/XP1024/XP12000
0	0	Simplex
1	0	Slz and SI390 pair status
2 or more	0	Slz and SI390 pair status for the pair whose T-VOL has the lowest LDEV ID
0	1	URz pair status
1	1	URz pair status
2 or more	1	URz pair status

Table 70 Currency of a shared Slz and URz volume

	URz Pair Status		
Slz Pair Status	Pending	Duplex	Suspended
Pending	Not current	Not current	Not current
Duplex	Not current	Not current	CURRENT
SP-Pending	Not current	Not current	CURRENT
V-Split	Not current	Not current	CURRENT
Split	CURRENT	CURRENT	CURRENT
Resync	Not current	Not current	CURRENT
Resync-r	-	-	CURRENT
Suspended	Not current	Not current	Not current

The configuration shown in Figure 92 is an example of a volume that is functioning as both an Slz S-VOL and a URz P-VOL. This configuration allows you to:

- Use ShadowImage for z/OS to provide on-site backup copies of URz P-VOLs, and/or

- Use URz to provide remote backup copies of ShadowImage for z/OS S-VOLs.

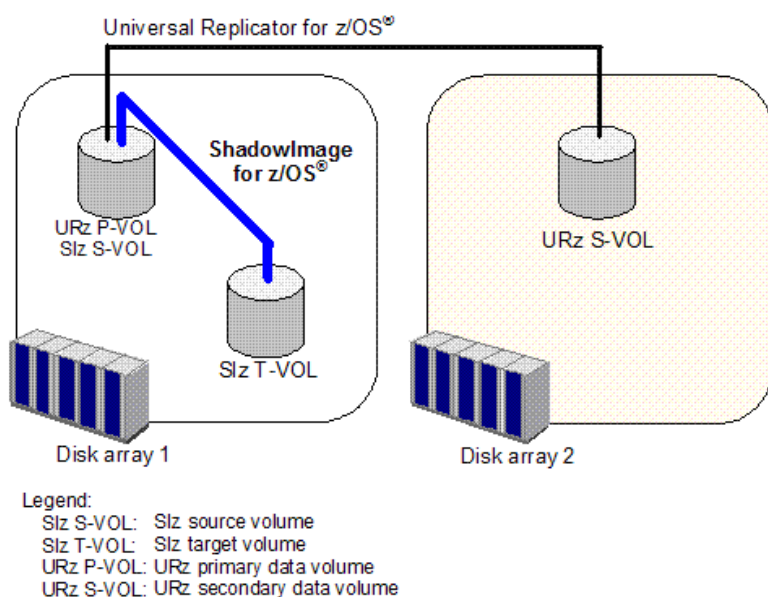


Figure 92 Slz and URz: Shared S-VOL/P-VOL

The configuration shown in [Figure 93](#) is an example of a volume that is functioning as both an Slz S-VOL and a URz S-VOL. This configuration allows you to use Slz to provide additional remote copies of URz S-VOLs.

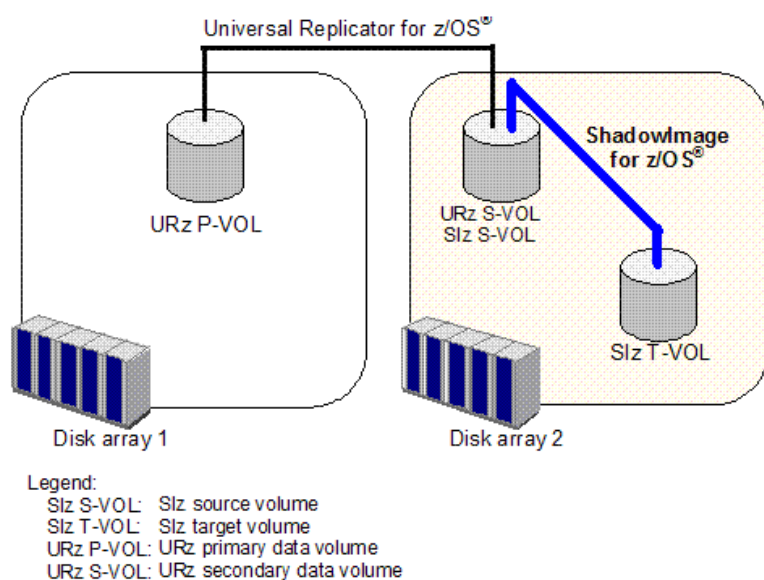


Figure 93 Slz and URz: Shared S-VOL/S-VOL

The configuration shown in [Figure 94](#) is an example of a volume that is functioning as both a URz P-VOL and an Slz S-VOL, while the S-VOL of the same URz pair is also functioning as the S-VOL of another Slz pair. This configuration allows you to:

- Use ShadowImage for z/OS to provide on-site backup copies of URz P-VOLs and S VOLS, and/or

- Use URz to provide remote backup of ShadowImage for z/OS S-VOLs.

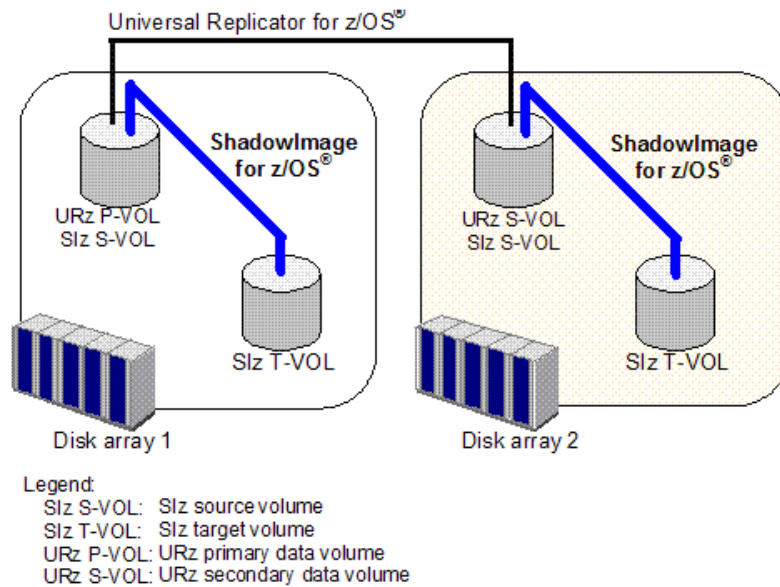



Figure 94 Slz and URz: Shared S-VOL/P-VOL and S-VOL/S-VOL

Starting ShadowImage

To start SI390:

1. From the Launch window, click an XP128, XP1024 or XP12000.
2. Click the **Mainframe** tab, and then click the **ShadowImage** button (). The ShadowImage main window displays the name of the connected XP128/XP1024/XP12000, the currently selected CU image, and all of the volumes (LDEVs) installed under the current CU image.

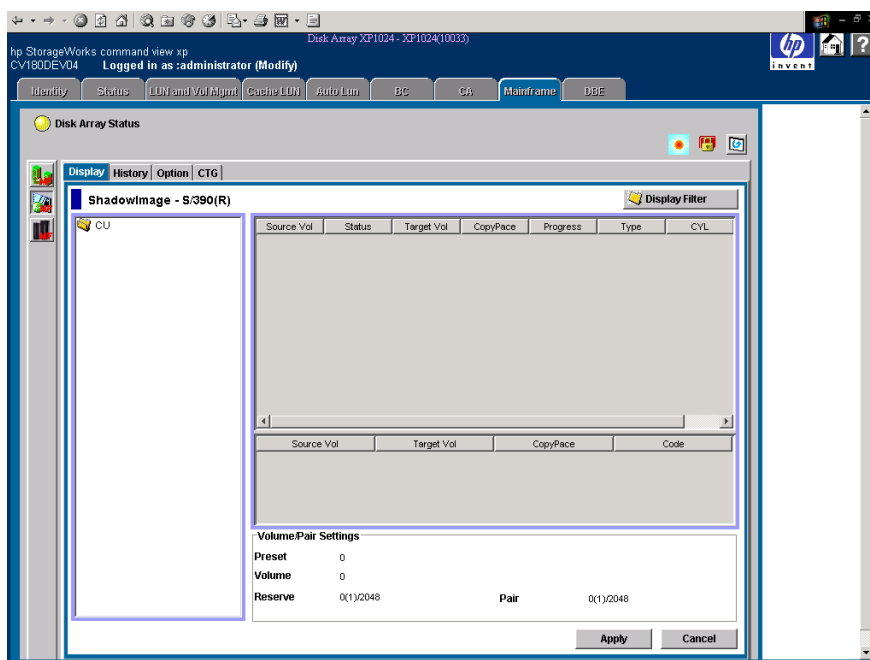


Figure 95 ShadowImage main window

To perform SI390 operations, first reserve the volumes that you plan to use as SI390 T-VOLs (see ["Setting the Reserve Attribute"](#) on page 266 for instructions), and then start adding the SI390 pairs (see ["Adding ShadowImage Pairs"](#) on page 268 for instructions).

ShadowImage Main Window

There are four tabs that you can access in ShadowImage: **Main**, **History**, **Options**, and **CTG** tabs.



NOTE: The **CTG** tab and its features are available only if the XP disk array has firmware version 21.07.04 or later installed.

This section discusses the **Main** tab. For information about the **History** tab, see ["Viewing the Past Record of Pair Operations"](#) on page 278; for the **Options** tab, see ["Setting ShadowImage Options"](#) on page 280; and for the **CTG** tab, see ["CTG Window"](#) on page 281.

Clicking the **Main** tab displays the ShadowImage main window. This window displays SI390 volume and pair information for the selected CU image of the connected XP128/XP1024/XP12000 and performs all SI390 operations.

The ShadowImage main window contains the following items:

- Use the **Tree View** box, on the left side of the window, to select a CU image or defined S-VOL (LDEV ID).



NOTE: You can filter the volumes or volume pairs displayed in the Volume List box in the upper-right corner of the **Main** tab, by selecting a CU image or a volume (LDEV ID) at a time. To display all volumes and pairs, select **CU** on the top of the Tree View box.

- The **Volume List** box, on the upper-right side of the window, displays all available volumes on the CU image selected in the Tree View box. You can sort the volumes by source volume (CU:LDEV), status, T-VOL (CU:LDEV), copy pace, progress of copying, device emulation type, and cylinder (capacity). You can also filter the volumes by reserve attribute, by pair condition, and pair status, in the Display Filter window. To open the Display Filter window, click **Display Filter**.
- The following icons indicate the status of a volume or pair on the ShadowImage windows:
 - S-VOL
 - T-VOL
 - Reserved volume
 - An error occurred during operations. This error icon is displayed in the Preset Volume List box on the ShadowImage main window.
- Clicking the **Display Filter** button filters the volumes displayed in the Volume List box.
- The **Preset Volume List** box, which is under the Volume List box, displays the specified operations (volume/pair information). These operations have not been performed in the XP128/XP1024/XP12000.



NOTE: You can use the Preset Volume List box to hold multiple settings of the same operation (for example, Add Pair) only. You cannot display different types of operations (for example, Split Pair and Resync Pair) in the Preset Volume List box at the same time. You can also cancel the operations in the Preset Volume List box. For information on the Preset Volume List box, refer to ["The Preset Volume List Box"](#) on page 264.

- The **Volume/Pair Settings** box displays:
 - **Preset:** The number of operations (volume/pair information) that have not been performed in the XP128/XP1024/XP12000. The Preset Volume List box, which is located below the Volume List box, displays the preset operations. Click **Apply** to perform the specified operations displayed in the Preset Volume List box.
 - **Volume:** The total number of volumes defined in the XP128/XP1024/XP12000.
 - **Reserve:** $X(Y)/Z$, where
 X = total number of SI390 reserved volumes
 Y = total number of SI390 and SI reserved volumes
 Z = maximum allowable number of reserved volumes
 - **Pair:** $X(Y)/Z$, where
 X = total number of SI390 pairs
 Y = total number of SI390 and SI pairs
 Z = maximum number of pairs (SI390/SI/Auto LUN)



NOTE: The value (Y) does not include Auto LUN XP pairs. If Auto LUN pairs exist, it is possible for the SI390 add pair operation to fail even if (Y) is less than 4,096.

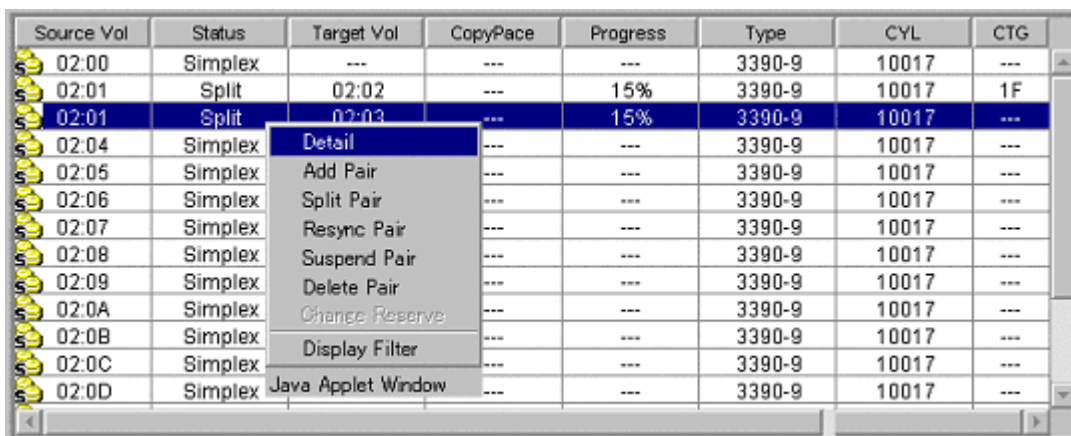
- The **Apply** button performs the SI390 operations displayed in the Preset Volume List box. If the specified operations complete successfully, the Preset Volume List box will be cleared. If an error occurs during an operation, an icon (🚫) is displayed and the failed operation will remain in the Preset Volume List box. You can display the error code and message for the failed operation by clicking the **Detail** command.
- The **Cancel** button cancels all operations specified in the Preset Volume List box.
- The **Refresh** button (🔄) updates the information displayed on the ShadowImage main window.

To perform SI390 operations for one or more volumes, select the volume(s) in the Volume List box, right-click to display the pop-up menu commands (**Detail**, **Add Pair**, **Split Pair**, **Resync Pair**, **Suspend Pair**, **Delete Pair**, **Change Reserve**, and **Display Filter**), and then click the appropriate command (see ["The Volume List Box"](#) on page 260).

For more information about the **History** and **Options** tabs of the ShadowImage main window, refer to ["Viewing the Past Record of Pair Operations"](#) on page 278 and ["Setting ShadowImage Options"](#) on page 280.

The Volume List Box

The Volume List box displays volume/pair information based on the filter options you select in the Tree View box. You can also filter the volumes by reserve attribute, by pair condition, and pair status by clicking **Display Filter**.



Source Vol	Status	Target Vol	CopyPace	Progress	Type	CYL	CTG
02:00	Simplex	---	---	---	3390-9	10017	---
02:01	Split	02:02	---	15%	3390-9	10017	1F
02:01	Split	02:03	---	15%	3390-9	10017	---
02:04	Simplex	---	---	---	3390-9	10017	---
02:05	Simplex	---	---	---	3390-9	10017	---
02:06	Simplex	---	---	---	3390-9	10017	---
02:07	Simplex	---	---	---	3390-9	10017	---
02:08	Simplex	---	---	---	3390-9	10017	---
02:09	Simplex	---	---	---	3390-9	10017	---
02:0A	Simplex	---	---	---	3390-9	10017	---
02:0B	Simplex	---	---	---	3390-9	10017	---
02:0C	Simplex	---	---	---	3390-9	10017	---
02:0D	Simplex	---	---	---	3390-9	10017	---

Context menu options: Detail, Add Pair, Split Pair, Resync Pair, Suspend Pair, Delete Pair, Change Reserve, Display Filter, Java Applet Window.

Figure 96 Volume List box

The Volume List box lists all installed volumes (LDEVs) on the selected CU image and displays the following information for each volume:

- **Source Vol:** The CU:LDEV (control unit image:logical device ID) of the source volume (S-VOL).
- **Status:** The SI390 pair status of the volume pair: **Simplex**, **Pending**, **Duplex**, **Split**, **Resync**, **Suspend**, **SP-Pend**, **Resync-R**, or **V-Split**.
- **Target Vol:** The CU:LDEV (control unit image:logical device ID) of the T-VOL. If there is no T-VOL, --- is displayed.
- **Copy Pace:** The specified copy pace (**Slower**, **Medium**, or **Faster**) is displayed.
- **Progress:** The information according to the pair status is displayed as shown in the following table.

Table 71 Displayed information in progress

Pair Status	Displayed Information
Simplex	--- is displayed.
Pending	The progress (%) of copying.
Duplex	Identical data (%) of S-VOL and T-VOL.
SP-Pend	Copy completed data (%).
V-Split	Copy completed data (%).
Split	Identical data (%) of S-VOL and T-VOL.
Resync	Identical data (%) of S-VOL and T-VOL.
Resync-R	Identical data (%) of S-VOL and T-VOL.
Suspend	--- is displayed.
F-Copy	Copy completed data (%).

- **Type:** The device emulation type (for example, 3390-9, 3390-3R, or 3390-3A/B/C). For details, see [Table 61](#) on page 234.
- **CYL:** The number of cylinders assigned to the volume.
- **CTG:** The registered ID of the consistency group.
- **CLPR (S):** The S-VOL's cache logical partition.
- **CLPR (T):** The T-VOL's cache logical partition.
- **Relation(s):** The current state of the volume in terms of whether the FlashCopy Mirror Version 2 relationship is established or not. When no relationship is established, -- is displayed. When a relationship is established, the status of the volume is displayed as shown in [Table 72](#). The parameter displayed in **Relation(s)** changes according to whether the volume is an S-VOL or T-VOL, or the settings are normal or not.

Table 72 Parameters displayed in **Relation(s)**

Volume	Parameter	
	S-Failed	Settings are Abnormal
S-VOL	S-Normal	S-Failed
T-VOL	T-Normal	T-Failed
Volume set for both S-VOL and T-VOL	ST-Normal	ST-Failed

You can perform SI390 operations for the volume(s) in the Volume List box by using the following pop-up menu commands, which you can display by right-clicking with the mouse:

Table 73 List of ShadowImage pop-up menu commands

Command	Feature
Detail	Opens the Detail window, which displays information for the selected volume or pair.
Add Pair	Opens the Add Pair Dialog window, which creates (adds) new SI390 pairs.
Split Pair	Opens the Split Volume Pair window, which splits SI390 pairs.
Resync Pair	Opens the Resync Volume Pair window, which resynchronizes SI390 pairs.
Suspend Pair	Opens the Suspend Volume Pair window, which suspends SI390 pairs.
Delete Pair	Opens the Delete Volume Pair window, which deletes SI390 pairs.
Change Reserve	Opens the Set Reserve Attribute or Reset Reserve Attribute window, which sets/resets the SI390 reserve attribute.
Display Filter	Opens the Display Filter window, which filters the volumes displayed in the Volume List box.
FlashCopy Info	Opens the FlashCopy Information panel that displays the information of the resources used by FlashCopy Mirror Version 2.

The Detail Window

The Detail window displays information for the selected volume or pair. To open the Detail window, select a pair or volume in the Volume List box on the ShadowImage main window, right-click to display the pop-up menu, and then click **Detail**. If the S-VOL of the selected pair has two or three T-VOLs that share the same S-VOL, the Detail window displays all the T-VOLs.



NOTE: SI390 supports the CQUERY/PPRCOPY QUERY commands for viewing SI390 pair status. For more information on using PPRC commands, see ["Using PPRC Commands for ShadowImage"](#) on page 284.

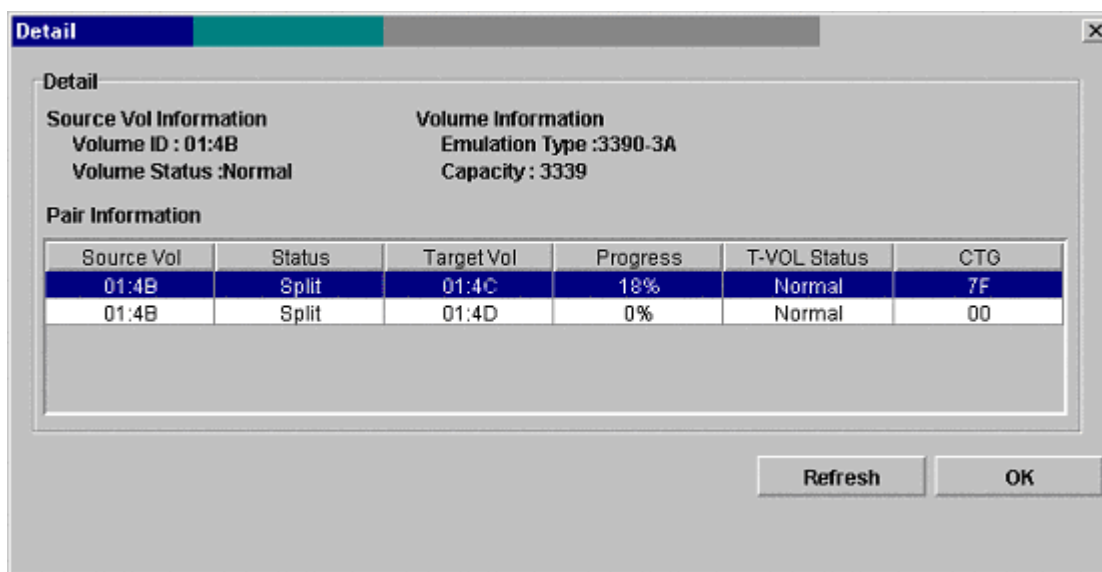


Figure 97 Detail window

The Detail window has the following features:

The **Detail** box displays the following:

- **Source Vol Information:** The source volume ID (CU image:LDEV ID), S-VOL status, and CLPR of the S-VOL.
- **Volume Information:** The emulation type and the capacity of the logical device (LDEV).
- The **Pair Information** box displays the following:
 - **Source Vol:** The source volume (S-VOL). The left of the colon (:) shows the CU image. The right of the colon (:) shows the ID of the logical device (LDEV).
 - **Status:** The status of the pair.
 - **Target Vol:** The target volume (T-VOL). The left of the colon (:) shows the CU image. The right of the colon (:) shows the ID of the logical device (LDEV).
 - **Progress:** The rate of copying in progress.
 - **T-VOL Status:** The status of the first path to the T-VOL.
 - **CLPR:** The cache logical partition of the S-VOL and the T-VOL.
 - **CTG:** The registered ID of the consistency group.
- The **Refresh** button updates the information displayed in the Detail window.

- The **OK** button closes the Detail window.

The Display Filter Window

Use the Display Filter window to filter the volumes displayed in the Volume List box by reserve attribute, by pair condition, and by pair status. To open the Display Filter window, click **Display Filter** on the ShadowImage main window. You can also open the Display Filter window by using the **Display Filter** command.

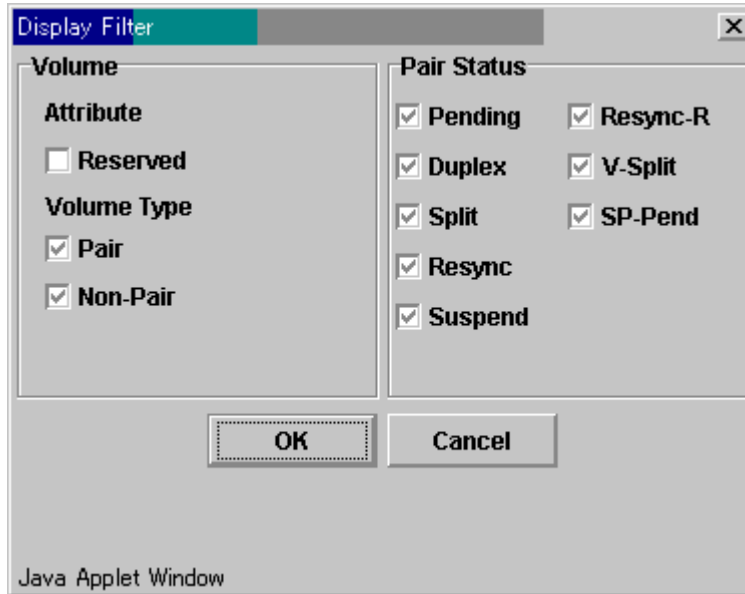


Figure 98 Detail Filter window

The Display Filter window has the following features:

- The **CLPR** list displays the specified cache logical partition (CLPR).
- The **Volume** box:
 - Select the **Reserved** check box to display reserved or unreserved volumes. If you select the **Reserved** check box, only reserved volumes are displayed in the Volume List box. If you clear the **Reserved** check box, only unreserved volumes are displayed.
 - Selecting the **Pair** check box displays paired volumes.
 - Selecting the **Non-Pair** check box displays non-paired (simplex) volumes.
- Use the **Pair Status** box to filter the pairs displayed in the Volume List box by pair status: **Pending**, **Duplex**, **Split**, **Resync**, **Suspend**, **Resync-R**, **V-Split**, **SP-Pend**, and **F-Copy**.



NOTE: All check boxes are selected by default.

- The **OK** button applies the settings and closes the Display Filter window.
- The **Cancel** button resets the settings and closes the Display Filter window.



NOTE: The filter settings are only effective within the current SI390 operations. If you switch to another option program (for example, TC390), or click a button on the toolbar, the settings will be reset.

The Preset Volume List Box

The Preset Volume List box is located below the Volume List box, and lists the specified zSeries and S/390 operations (volume/pair information) that have not been performed in the XP128/XP1024/XP12000.



NOTE: You can use the Preset Volume List box to hold multiple settings of the same operation (for example, Add Pair) only. You cannot display different types of operations (for example, Split Pair and Resync Pair) in the Preset Volume List box at the same time. You can also cancel the operations in the Preset Volume List box.






Source Vol	Target Vol	CopyPace	Code
 00:84	00:89	Medium	---
 00:85	00:8A	Delete	---
 00:86	00:8E	Delete All	---
 00:87	00:8F	Detail	---

Figure 99 Preset Volume List box displaying settings (operations)

The Preset Volume List box displays the following information of specified operations:

- **Source Vol:** The CU:LDEV (control unit image:logical device ID) of the S-VOL.
- **Target Vol:** The CU:LDEV (control unit image:logical device ID) of the T-VOL.
- **Copy Pace:** The copying pace for all pairs being created: **Slower**, **Medium**, and **Faster**.
- **CLPR (S):** The cache logical partition (CLPR) of the S-VOL.
- **CLPR (T):** The cache logical partition (CLPR) of the T-VOL.
- **Code:** The reason code is displayed if the preset operations (settings) cannot be applied successfully with the **Apply** button.

To perform the specified operations, click **Apply** on the ShadowImage main window. When all the operations are performed successfully, the Preset Volume List box will be cleared. However, if some operations cannot be performed successfully, the failed operations will remain in the Preset Volume List box, and the error icon () is displayed. You can also cancel one or all operations by using the following pop-up menu commands:

- The **Delete** command cancels the selected operation only.



NOTE: To display the **Delete** command, select a volume or pair, and then right-click to display the pop-up menu.

- The **Delete All** command cancels all operations displayed in the Preset Volume List box.



NOTE: To display the **All Delete** command, deselect any volume or pair, and then right-click to display the pop-up menu.

- The **Detail** command displays the Error window, which displays the error code and message for the failed operation (see "[ShadowImage Error Window](#)" on page 313).

FlashCopy Information Pane

The FlashCopy Information pane displays information about resources, such as total and remaining number of pair tables and differential tables that can be used for FlashCopy Mirror Version 2 operation, or information about FlashCopy Mirror Version 2 pairs. Use this information to calculate the number of FlashCopy Mirror Version 2 pairs that can be established. To open the FlashCopy Information window, select **FlashCopy Info** displayed in the pop-up menu in the ShadowImage z/OS main panel.

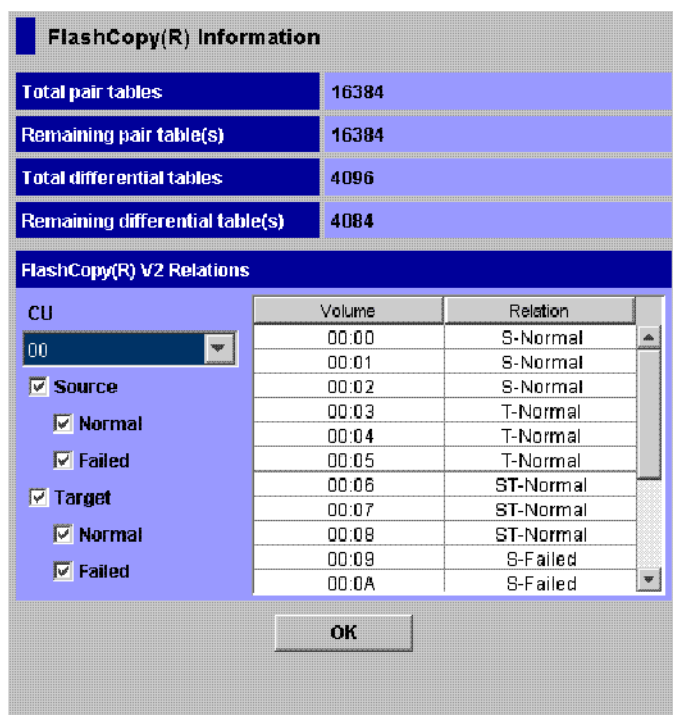


Figure 100 FlashCopy Information pane

The FlashCopy information pane displays the following information:

- **Total pair tables:** The total number of pair tables that can be used for FlashCopy Mirror Version 2 operations, including pair tables being used by FlashCopy Mirror Version 2.
- **Remaining pair table(s):** The remaining number of pair tables that can be used for FlashCopy Mirror Version 2 operation.
- **Total differential tables:** The total number of differential tables that can be used for FlashCopy Mirror Version 2 operation.
- **Remaining differential pair table(s):** The remaining number of differential tables that can be used for FlashCopy Mirror Version 2 operation.
- **FlashCopy V2 Relations:** Information about FlashCopy Mirror Version 2 pairs in the volume list. You can select information displayed in this volume list using the **CU** list and check boxes below.
 - **CU list:** Select the CU containing volumes you want to display in the volume list.
 - **Check boxes:** Select the type and status of volumes you want to display in the volume list. [Table 74](#) shows the features of each check box.

Table 74 Check Boxes in FlashCopy V2 Relations

Check Box	Displayed Information
Source	S-VOLs of the FlashCopy Mirror Version 2 pairs

Table 74 Check Boxes in FlashCopy V2 Relations

Check Box	Displayed Information
Target	T-VOLs of the FlashCopy Mirror Version 2 pairs
Normal	Volumes of the FlashCopy Mirror Version 2 pairs in normal status
Failed	Volumes of the FlashCopy Mirror Version 2 pairs in abnormal status

- Volume list: Displays information about volumes that form FlashCopy Mirror Version 2 pairs. You can select volumes displayed in this volume list using the **CU** list and check boxes.
- **OK**: Closes the FlashCopy Information pane.

Performing ShadowImage Operations

Setting the Reserve Attribute

Use the Set Reserve Attribute window to set the reserve attribute for the volume(s) selected on the ShadowImage main window. To open the Set Reserve Attribute window, select one or more unreserved *simplex* volumes in the Volume List box on the ShadowImage main window, right-click to display the pop-up menu, and then click **Change Reserve**.



NOTE: The reserve attribute is only required for SI390 operations on Command View. The PPRC commands require that the potential T-VOLs are offline to the host, but do not require that the T-VOLs have the reserve attribute setting.

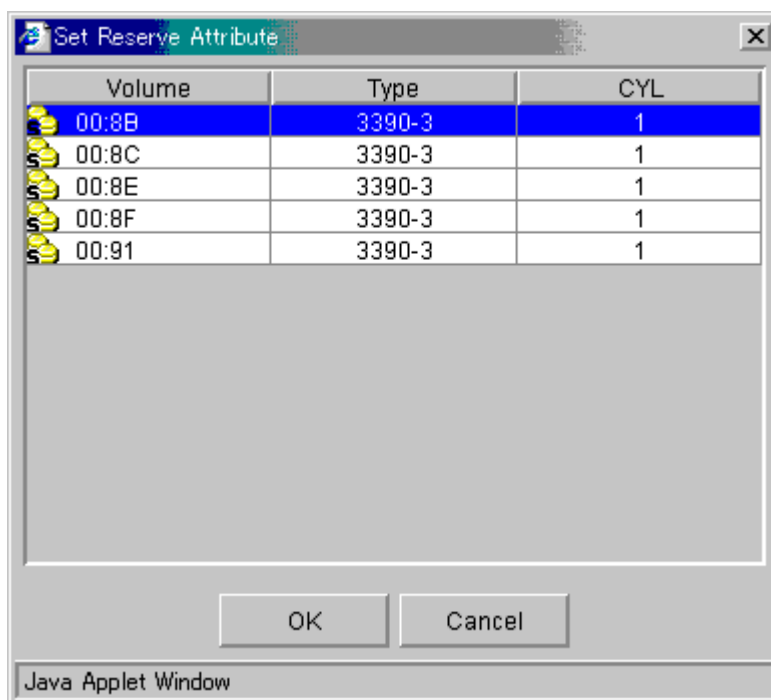


Figure 101 Set Reserve Attribute window

The Set Reserve Attribute window displays the unreserved volume(s) that you selected on the ShadowImage main window. The **OK** button sets the reserve attribute for unreserved volume(s).



NOTE: The Preset Volume List box on the ShadowImage main window displays the setting(s). The **Cancel** button closes the Set Reserve Attribute window without changing the settings. To apply the settings to the XP128/XP1024/XP12000, click **Apply** on the ShadowImage main window.

To reserve one or more volumes for use as SI390 S-VOLs (set the reserve attribute):

1. Vary the volume(s) that you will be reserving offline. The XP128/XP1024/XP12000 will reject all read/write I/Os to reserved volumes (except when in the *split* state).
2. From the ShadowImage main window, click the appropriate CU image or LDEV in the Tree View box.
3. Display unreserved *simplex* volumes in the Volume List box (for example, to display unreserved *simplex* volumes, clear the **Reserve** and **Pair** check boxes, and select the **Non-Pair** check box on the Display Filter window).
4. Select the volume(s), right-click to display the pop-up menu, and then click **Change Reserve**. The Set Reserve Attribute window is displayed. If the **Change Reserve** command is not enabled, you selected paired volumes. Select only unreserved and unpaired volumes.
5. From the Set Reserve Attribute window, click the volume(s) you want to reserve and then click **OK**.
6. The setting will be reflected in the Preset Volume List box on the ShadowImage main window.
7. From the ShadowImage main window, click **Apply**.
8. Verify that the settings are reflected in the XP128/XP1024/XP12000. Check the attribute by clicking **Display Filter**.

Resetting the Reserve Attribute

Use the Reset Reserve Attribute window to reset the reserve attribute for (that is, unreserve) the volume(s) selected on the ShadowImage main window. To open the Reset Reserve Attribute window, select one or more reserved *simplex* volumes in the Volume List box on the ShadowImage main window, right-click to display the pop-up menu, and then click **Change Reserve**.

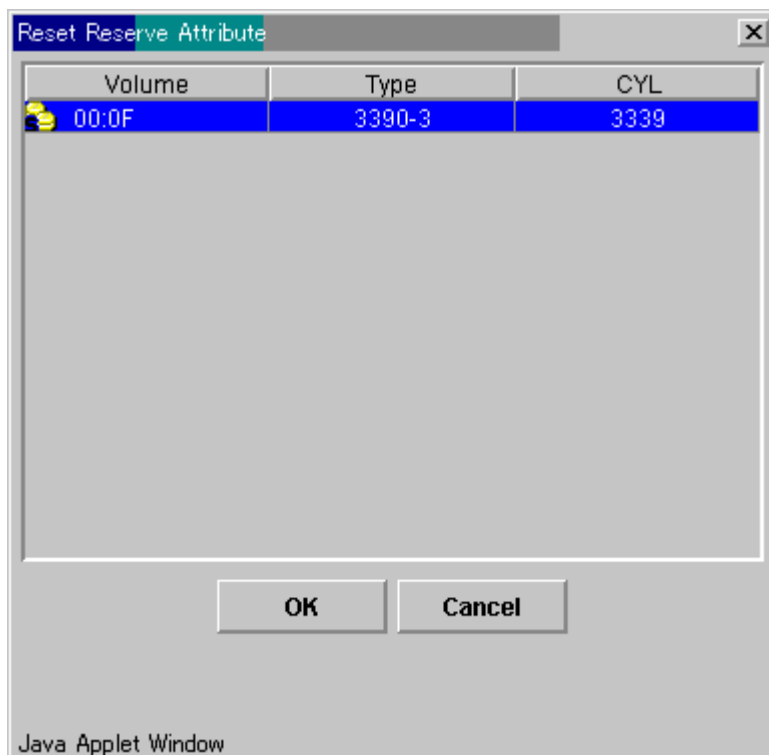


Figure 102 Reset Reserve Attribute window (unreserve)

The Reset Reserve Attribute window displays the reserved volume(s) that you selected on the ShadowImage main window. The **OK** button resets the reserve attribute for reserved volume(s).



NOTE: The Preset Volume List box on the ShadowImage main window displays the setting(s). The **Cancel** button closes the Reset Reserve Attribute window without changing the settings. To apply the settings to the XP128/XP1024/XP12000, click **Apply** on the ShadowImage main window.

To unreserve one or more volumes (reset the reserve attribute):

1. Verify that the volumes you want to unreserve are no longer assigned to SI390 pairs as T-VOLs. For instructions on deleting SI390 pairs, see “[Deleting ShadowImage Pairs](#)” on page 277.
2. From the ShadowImage main window, click the CU image or LDEV in the Tree View box.
3. Display reserved *simplex* volumes in the Volume List box. For example, to display reserved *simplex* volumes, select the **Reserved** check box in the Display Filter window.
4. Select the volume(s), right-click to display the pop-up menu, and then click **Change Reserve**. The Reset Reserve Attribute window is displayed. If the **Change Reserve** command is not enabled, you selected paired volumes. Select only reserved and unpaired volumes.
5. From the Reset Reserve Attribute window, click the volume(s) you want to unreserve and then click **OK**. The setting will be reflected in the Preset Volume List box on the ShadowImage main window.
6. From the ShadowImage main window, click **Apply**.
7. Verify that the settings are reflected in the XP128/XP1024/XP12000. Check the attribute by clicking **Display Filter**.

Adding ShadowImage Pairs



CAUTION: The SI390 add pair operation overwrites all data on the T-VOLs. The user is responsible for backing up the data on the T-VOLs before adding SI390 pairs.

In addition to displaying the S-VOL and T-VOL information for the pair(s) being added, you can use the Add Pair Dialog window to select the T-VOL(s) for each S-VOL, set the copy pace for all pairs being added, and start the Add Pair operation(s). To open the Add Pair Dialog window, select one or more pair or volumes in the Volume List box on the ShadowImage main window, right-click to display the pop-up menu, and then click **Add Pair**.



NOTE: SI390 supports the CESTPAIR/PPRCOPY ESTPAIR commands for adding (starting) SI390 pairs. For more information on using PPRC commands, see ["Using PPRC Commands for ShadowImage"](#) on page 284.

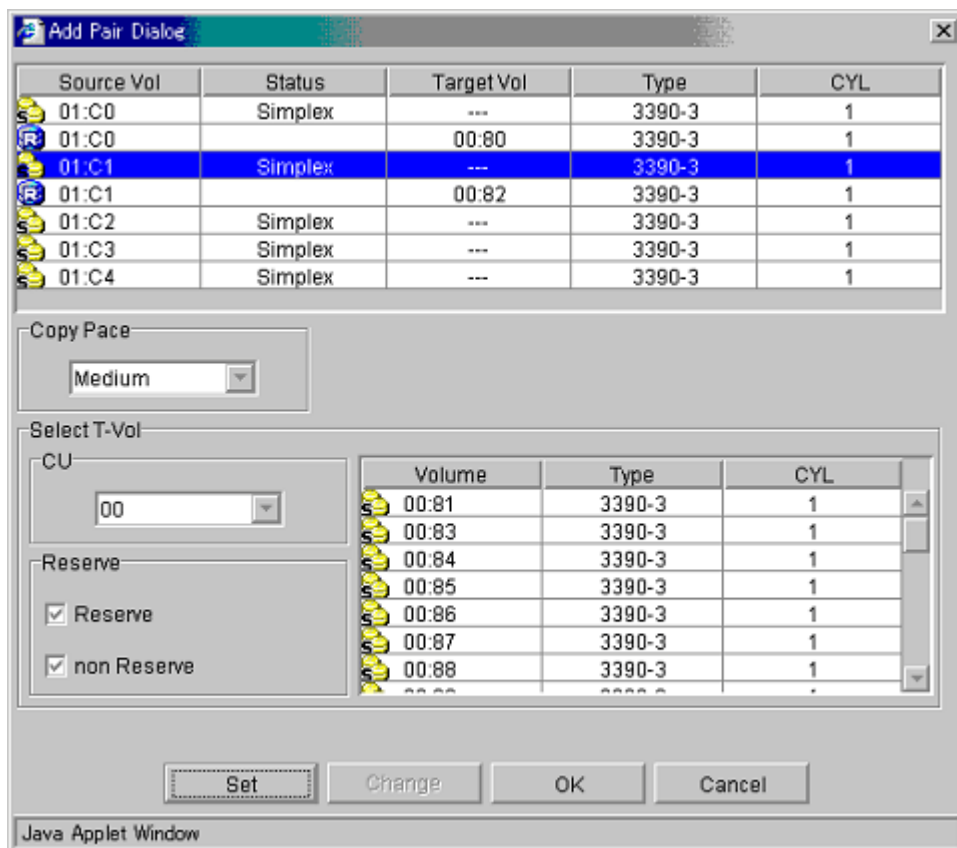


Figure 103 Add Pair Dialog window

The Add Pair Dialog window displays the S-VOL and T-VOL information for each pair being added: CU image, LDEV ID, volume status, emulation type, capacity (cylinders). Use the **Copy Pace** box to select the copy pace for all pairs being added: **Slower**, **Medium**, and **Faster**.



NOTE: When the Preset Volume List box already holds some Add Pair settings and you specify a different copy pace for new pairs in the Add Pair Dialog window, the copy pace for the existing Add Pair settings displayed in the Preset Volume List box will be also changed. The latest copy pace specified in the Add Pair Dialog window is always reflected to the disk array.

Use the **Select T-Vol** box to filter the T-VOLs displayed in the T-VOL list. Use the **Reserve** box to display the available T-VOLs by reserve attribute. **CLPR** indicates the cache logical partition of the T-VOL.

The **Set** button adds the selected T-VOL to the selected S-VOL. The **Change** button replaces the T-VOL of the selected pair in the list with the selected T-VOL. To remove any volumes from the S-VOL or T-VOL list, select the volumes, right-click to display the pop-up menu, and then click **Delete**. The **OK** reflects the new pairs in the list to the Preset Volume List box on the ShadowImage main window.



NOTE: To add all pairs in the list, click **Apply** on the ShadowImage main window. The **Cancel** button closes the Add Pair Dialog window without changing the settings.

If you want to add new SI390 pairs and then split them immediately so that you can access the T-VOLs as soon as possible, use the Split Pair operation instead of the Add Pair operation to establish and split new pairs at the same time (see “[Splitting ShadowImage Pairs](#)” on page 271 for instructions).

To add one or more new SI390 pairs:

1. Verify that the appropriate T-VOL(s) is/are offline.
2. From the ShadowImage main window, click the CU image or LDEV in the Tree View box to filter the volumes displayed in the Volume List box.
3. Select the S-VOL(s) for the new pair(s), right-click to display the pop-up menu, and then click **Add Pair** to open the Add Pair Dialog window.




NOTE: Do not select any reserved volumes.

-
4. Set the initial copy pace for all pairs being added: **Slower**, **Medium**, or **Faster**.
 5. Verify that the Add Pair Dialog window displays the appropriate S-VOL(s). If you want to remove any volumes from the list, select the volume(s), right-click to display the pop-up menu, and then click **Delete**.
 6. Select the T-VOL(s) for each S-VOL as follows:
 - a. Click the S-VOL in the Add Pair Dialog window.
 - b. Click the CU in the **CU** list, select the **Reserve** check box to display reserved volumes, and then click the T-VOL.
 - c. Click **Set** to create (add) the T-VOL to the selected S-VOL. The T-VOL is now displayed next to the selected S-VOL.



NOTE: You can select an unreserved volume as the T-VOL. When you create the pair, the XP128/XP1024/XP12000 changes the reserve attribute to “reserved” automatically.

-
- d. To add a second and/or third T-VOL to the same S-VOL, repeat [step 6b](#) - [step 6c](#) to add each T-VOL to the selected S-VOL. Each pair to be created is displayed separately in the list of pairs in the Add Pair Dialog window.
7. Repeat [step 6](#) until all necessary pairs are displayed. Click **Change** to replace a T-VOL, click **Set** to add a T-VOL, and use the **Delete** command to remove pairs.
 8. When the Add Pair Dialog window displays the new pair(s), click **OK** to reflect all pairs (settings) in the list to the Preset Volume List box on the ShadowImage main window.
 9. From the ShadowImage main window, click **Apply** to create the pair(s).

When the initial copy operation(s) start, the ShadowImage main window shows the new pairs with *pending* status and the progress (%) of the initial copy operation(s).
 10. Click the **Refresh** button () to monitor the progress of the initial copy operation(s).

Splitting ShadowImage Pairs

In addition to displaying volume and pair information for the volume(s) and/or pair(s) selected on the ShadowImage main window, you can use the Split Volume Pair window to split existing SI390 pairs. The Split Volume Pair window can also be used to simultaneously add and split new SI390 pairs (see "Adding and Splitting Pairs" on page 272). To open the Split Volume Pair window, select volume(s) or pair(s) in the Volume List box on the ShadowImage main window, right-click to display the pop-up menu, and then click **Split Pair**.



NOTE: SI390 supports the CSUSPEND/PPRCOPY SUSPEND commands for splitting SI390 pairs. For more information on using PPRC commands, see "Using PPRC Commands for ShadowImage" on page 284.

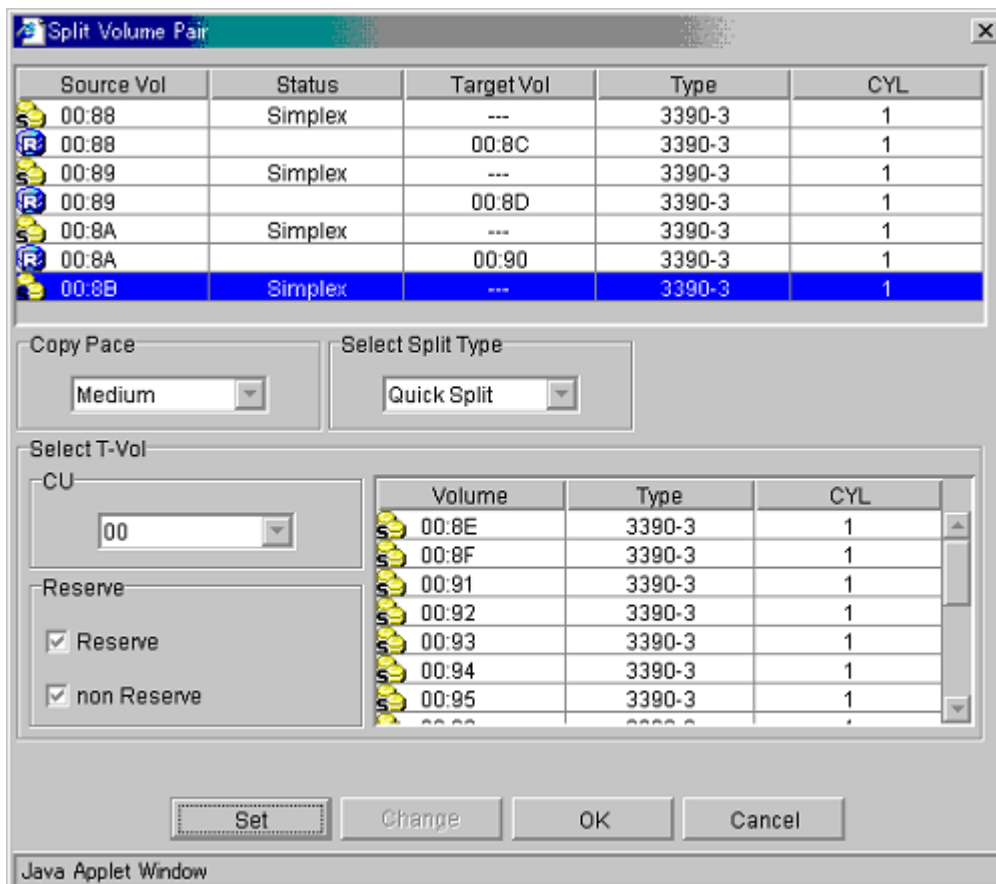


Figure 104 Split Volume Pair window

The Split Volume Pair window lists the volume(s)/pair(s) selected on the ShadowImage main window, and shows the pair status and copy pace for each pair. Use the **Copy Pace** box to select the copy pace for all pairs that you are splitting: **Slower**, **Medium**, or **Faster**. Use the **Select Split Type** box to select the split type for all pairs that you are splitting: **Quick Split** or **Steady Split**. **CLPR** indicates the cache logical partition of the T-VOL.

Use the **Select T-Vol** box to filter the T-VOLs displayed in the T-VOL list. The **CU** and **Reserve** boxes display the available S-VOLs by port and by reserve attribute.

The **Set** button adds the selected T-VOL to the selected S-VOL. The **Change** button replaces the T-VOL of the selected pair in the list with the selected T-VOL. To remove any volumes from the list, select the unneeded volumes, right-click to display the pop-up menu, and then click **Delete**. The **OK** button reflects all settings to the Preset Volume List box on the ShadowImage main window.



NOTE: Click **Apply** on the ShadowImage main window to split all pairs in the Preset Volume List box. The **Cancel** button closes the Pairsplit window without changing the settings.

To split one or more existing SI390 pairs:

1. If you want the split T-VOLs to be identical to the S-VOLs, stop all write operations to the S-VOLs before splitting the pairs. This ensures that there are no updates to the S-VOLs while the split operations are synchronizing the T-VOLs to the S-VOLs.



CAUTION: The S-VOL and T-VOL are synchronized only when the pair status changes from SP-Pend or V-Split to Split. Due to the SI390 asynchronous update copy operations, this status transition can take several minutes.

2. From the ShadowImage main window, click the CU image or LDEV in the Tree View box to filter the volumes displayed in the Volume List box.
3. Select the pair(s) you want to split, right-click to display the pop-up menu, and then click **Split Pair** to open the Split Volume Pair window. You cannot split a suspended pair.
4. From the Split Volume Pair window, set the copy pace (**Slower**, **Medium**, or **Faster**) for all pairs being split.



NOTE: If you change the setting, the last setting will become effective.

5. Set the split type (**Quick Split** or **Steady Split**) for all pairs being split.



NOTE: The split type is set for all pairs being split. If you change the setting, the latest setting is applied to all pairs.

6. When the Split Volume Pair window displays the pair(s), click **OK** to reflect all pairs to the Preset Volume List box on the ShadowImage main window.



NOTE: Use the **Delete** command to remove any pairs from the list.

7. From the ShadowImage main window, click **Apply** to split the pair(s).

When the pairsplit operation(s) start, the ShadowImage main window shows the new pairs with *SP-Pend* or *V-Split* status and the progress (%) of the update copy operation(s). The *Split* status is displayed right away if there were no pending update copy operations.

8. Click the **Refresh** button () to monitor the progress of the split operation(s).

Adding and Splitting Pairs

The split operation can also be used to simultaneously add and split new SI390 pairs. In this case, the split operation changes the pair status from *simplex* to *SP-Pend* or *V-split*, copies all data on the S-VOL to the T-VOL, and then changes the pair status to *Split*.



NOTE: The combined add and split operation can be performed using PPRC commands. Refer to [Table 79](#) on page 285 and [Table 80](#) on page 289.

To add and split one or more new SI390 pairs with a single Command View operation:

1. If you want the split T-VOLs to be identical to the S-VOLs, stop all write operations to the S-VOLs before adding and splitting the pairs. This ensures that there are no updates to the S-VOLs while the split operations are synchronizing the T-VOLs to the S-VOLs.




CAUTION: The S-VOL and T-VOL are synchronized only when the pair status changes from SP-Pend or V-Split to Split. Due to the SI390 asynchronous update copy operations, this status transition can take several minutes.

2. From the ShadowImage main window, click the CU image or LDEV in the Tree View box to filter the volumes displayed in the Volume List box (for example, to display unreserved simplex volumes).
3. Select the volume(s) that will be the S-VOL(s) of the new pairs to be added and split, right-click to display the pop-up menu, and then click **Split Pair** to open the Split Volume Pair window.
4. Set the copy pace (**Slower**, **Medium**, or **Faster**) and split type (**Quick** or **Steady**) for all pairs being added and split.
5. Specify the T-VOL(s) as follows:
 - a. Click the S-VOL.
 - b. Click the CU image in the **CU** list, display either reserved or unreserved volumes, and then click the T-VOL.



NOTE: You can select unreserved T-VOL because the disk array will automatically reserve the T-VOL.

- c. Click **Set** to add the T-VOL to the selected S-VOL. The T-VOL is now displayed below the selected S-VOL.
 - d. To add another T-VOL to the same S-VOL, repeat [step 5b](#) - [step 5c](#) to add the next T-VOL to the selected S-VOL. Each pair to be added and split is displayed separately in the list of pairs.
6. Repeat [step 5](#) until the pair(s) is/are displayed. Click **Change** to replace T-VOLs, click **Set** to add T-VOLs, and use the **Delete** command to remove pairs.
 7. Click **OK** to reflect the settings to the Preset Volume List box on the ShadowImage main window.
 8. From the ShadowImage main window, click **Apply** to create and split the pair(s).
When the split operation(s) start, the ShadowImage main window shows the new pairs with *SP-Pend* or *V-Split* status and the progress (%) of the update copy operation(s). The *Split* status is displayed right away if there were no pending update copy operations.
 9. Click the **Refresh** button () to monitor the progress of the pairsplit operation(s).

Resynchronizing ShadowImage Pairs

In addition to displaying pair information for the pair(s) selected on the ShadowImage main window, you can use the Resynchronize Volume Pair window to resynchronize the pair(s). To open the Resynchronize Volume Pair window, select one or more pairs in the Split, V-Split or Suspended status in the Volume List box on the ShadowImage main window, right-click to display the pop-up menu, and then click **Resync Pair**.



NOTE: SI390 supports the CESTPAIR/PPRCOPY ESTPAIR commands for resynchronizing split or suspended SI390 pairs. For more information on using PPRC commands, see “Using PPRC Commands for ShadowImage” on page 284.

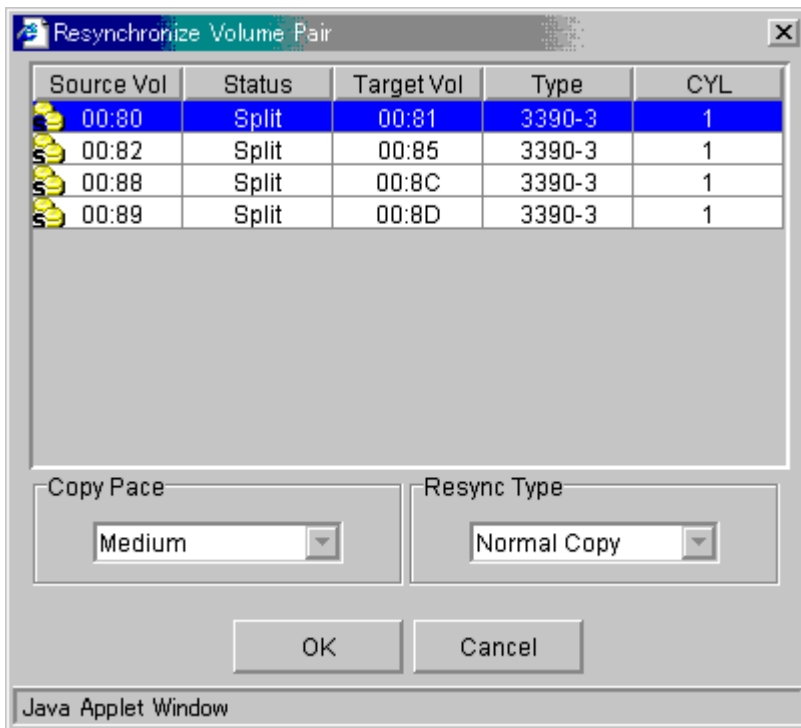


Figure 105 Resynchronize Volume Pair window

The Resynchronize Volume Pair window lists the pair(s) selected on the ShadowImage main window and shows the pair status and copy pace for each pair. Use the **Copy Pace** box to select the copy pace for the pairs being resynchronized: **Slower**, **Medium**, or **Faster**. Use the **Resync Type** box to select the pairresync type for the pairs being resynchronized: **Normal Copy**, **Quick Resync**, **Reverse Copy**, or **Quick Restore**.

The **OK** button adds the specified pair(s) to the Preset Volume List box on the ShadowImage main window.



NOTE: Click **Apply** on the ShadowImage main window to start the resync operation for the specified pair(s). The **Cancel** button closes the Resynchronize Volume Pair window and returns you to the ShadowImage main window. To remove any pair(s) from the list, select the unneeded pair(s), right-click to display the pop-up menu, and then click **Delete**.

To resynchronize one or more SI390 pairs:

1. Vary the split T-VOLs offline before starting the resync operations. When the resync operation starts, the XP128/XP1024/XP12000 will stop accepting write I/Os to the T-VOL.
2. From the ShadowImage main window, click the CU image or LDEV in the Tree View box to filter the volumes displayed in the Volume List box (for example, to display only split and suspended SI390 pairs).
3. From the ShadowImage main window, select the pair(s) you want to resync, right-click to display the pop-up menu, and then click **Resync Pair** to open the Resynchronize Volume Pair window.
4. From the Resynchronize Volume Pair window, click the pair(s), and set the copy pace (**Slower**, **Medium**, or **Faster**) and resync type (**Normal Copy**, **Quick Resync**, **Reverse Copy**, or **Quick Restore**) for

each pair. Reverse and quick restore pairresync cannot be performed on pairs in the *V-Split* or *Suspended* status.



CAUTION: Make sure to select the correct resync direction (normal/quick, or reverse/quick restore).

During the quick restore operation, the RAID levels, HDD types, and Cache LUN XP settings are swapped. To avoid performance impact due to quick restore operations:

- a. Verify that the S-VOL and T-VOL have the same RAID level and HDD type before performing the quick restore operation. If you want to restore the original RAID levels after quick restore, stop host I/Os to the pair, split the pair, perform the quick restore operation for that pair again, and then restart the host I/Os to the pair.
- b. Because the Cache LUN XP settings are exchanged during a quick restore operation, you must perform one of the two following operations. If you do not, the change of location of the cache residence areas may cause I/O performance to the Cache LUN XP data to be down.
 - Set the same Cache LUN XP settings (locations) for the S-VOL and T-VOL before performing the quick restore operation.
 - Release the Cache LUN XP settings of the S-VOL and T-VOL before the quick restore operation, and then reset the Cache LUN XP settings of the S-VOL and T-VOL after the pair changes to *duplex* status as a result of the quick restore operation.



NOTE: If you do not want to resynchronize the S-VOL and T-VOL after the quick restore operation, you must set the Swap&Freeze option before performing the quick restore operation (see "[Swap&Freeze Option](#)" on page 243 and "[Setting ShadowImage Options](#)" on page 280).

5. Click **OK** to reflect the settings to the Preset Volume List box on the ShadowImage main window.
6. Repeat [step 4](#) - [step 5](#) until the Preset Volume List box on the ShadowImage main window displays the necessary pairs (settings).



NOTE: Make sure to vary the T-VOL(s) offline before starting resync operations.

7. From the ShadowImage main window, click **Apply** to resync the specified pair(s).

The ShadowImage main window now displays the result(s) of the pairresync operation(s) (pair status changed to *resync*, *resync-R*, or *duplex*).

8. Click the **Refresh** button () to monitor the progress of the resync operation(s).

Suspending ShadowImage Pairs

In addition to displaying pair information for the pair(s) selected on the ShadowImage main window, you can use the Suspend Volume Pair window to suspend the pair(s). To open the Suspend Volume Pair window, select one or more pairs in the Volume List box on the ShadowImage main window, right-click to display the pop-up menu, and then click **Suspend Pair**.



NOTE: The CSUSPEND/PPRCOPY SUSPEND commands execute an SI390 split operation. There is no TSO/ICKDSF command equivalent for manually suspending pairs. For more information on using PPRC commands, see “Using PPRC Commands for ShadowImage” on page 284.

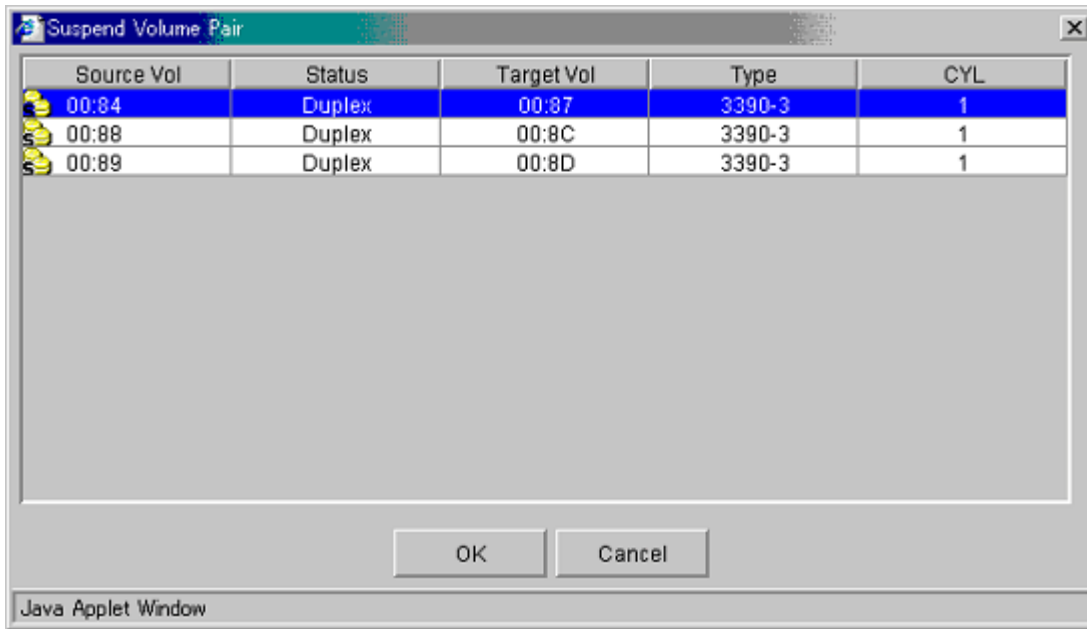


Figure 106 Suspend Volume Pair window

The Suspend Volume Pair window lists the pair(s) selected on the ShadowImage main window and shows the pair status and copy pace for each pair. The **OK** button suspends the selected pair(s). The **Cancel** button closes the Suspend Volume Pair window and returns you to the ShadowImage main window.

To suspend one or more SI390 pairs:

1. From the ShadowImage main window, click the CU image or LDEV in the Tree View box to filter the volumes displayed in the Volume List box.
2. Select the pair(s) that you want to suspend (or the volume(s) whose pairs you want to suspend), right-click to display the pop-up menu, and then click **Suspend Pair** to open the Suspend Volume Pair window.
3. From the Suspend Volume Pair window, click the pair(s) you want to suspend and then click **OK** to reflect the settings to the Preset Volume List box on the ShadowImage main window.



NOTE: To remove pair(s) from the list, select the unneeded pair(s), right-click to display the pop-up menu, and then click **Delete**.

4. Repeat [step 2](#) - [step 3](#) to suspend additional pairs in the list.
5. From the ShadowImage main window, click **Apply** to suspend the specified pair(s).

The ShadowImage main window now displays the result(s) of the suspend operation(s) (pair status changed to *Suspend*).

6. Click the **Refresh** button () to display the latest information.

Deleting ShadowImage Pairs

In addition to displaying pair information for the pair(s) selected on the ShadowImage main window, you can use the Delete Volume Pair window to delete the pair(s). To open the Delete Volume Pair window, select one or more pairs (except *Simplex* and *V-Split* pairs) in the Volume List box on the ShadowImage main window, right-click to display the pop-up menu, and then click **Delete Pair**.



NOTE: SI390 supports the CDELPAR/PPRCOPY DELPAIR commands for deleting SI390 pairs. For more information on using PPRC commands, see ["Using PPRC Commands for ShadowImage"](#) on page 284.

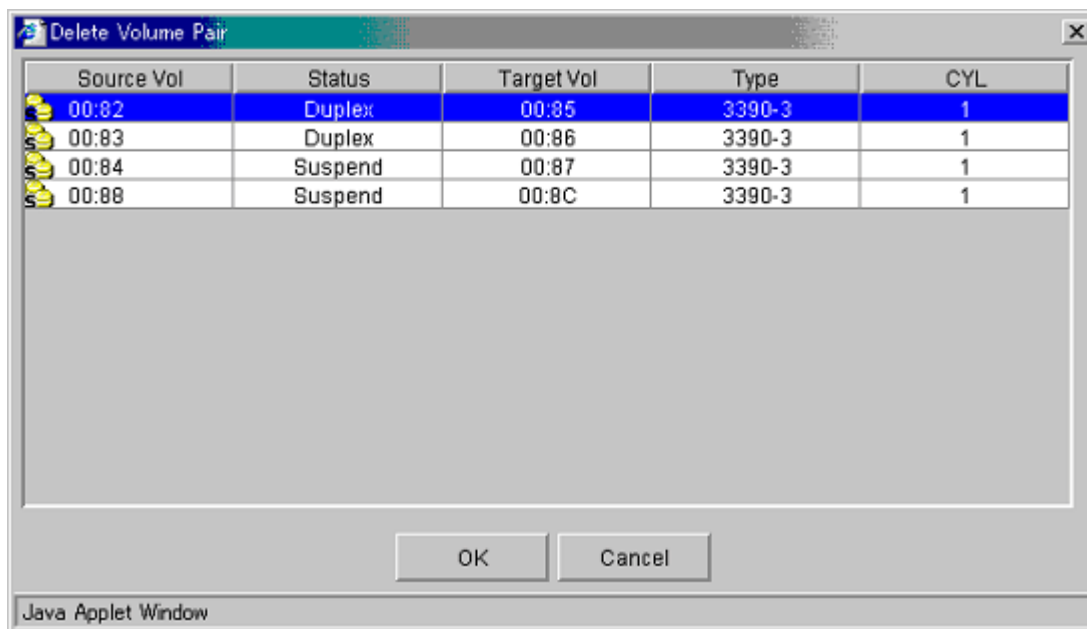


Figure 107 Delete Volume Pair window

The Delete Volume Pair window lists the pair(s) selected on the ShadowImage main window and shows the pair status and copy pace for each pair. The **OK** button deletes the selected pair(s). The **Cancel** button closes the Delete Volume Pair window and returns you to the ShadowImage main window.


To delete one or more SI390 pairs:

1. If you want to synchronize the S-VOL and T-VOL before deleting the pair:
 - a. Wait until all write I/Os to the S-VOL are complete, and then take the S-VOL offline to prevent the S-VOL from being updated during or after the delete operation.
 - b. After the S-VOL is offline, suspend the pair to copy all pending updates to the T-VOL.
 - c. When the pair status changes to *Split*, the S-VOL and T-VOL are synchronized.
2. From the ShadowImage main window, click the CU image or LDEV in the Tree View box to filter the volumes displayed in the Volume List box.
3. Select the pair(s) that you want to delete (or the volume(s) whose pairs you want to delete), right-click to display the pop-up menu, and then click **Delete Pair** to open the Delete Volume Pair window.



NOTE: Pairs with V-Split status cannot be deleted. To remove pair(s) from the list, select the unneeded pair(s), right-click to display the pop-up menu, and then click **Delete**.

4. From the Delete Volume Pair window, click the pair(s) you want to delete and then click **OK** to reflect the settings to the Preset Volume List box on the ShadowImage main window.

5. From the ShadowImage main window, click **Apply** to delete the specified pair(s) or volume(s).
The ShadowImage main window now displays the result(s) of the delete operation(s).
6. Click the **Refresh** button () to display the latest information.

Viewing the Past Record of Pair Operations

The History window displays current SI390 pair status information as well as SI390 pair history information for the selected CU image.

To display the History window, click the **History** tab. The past records of ShadowImage for z/OS and FlashCopy Mirror Version 2 pair appear in different lists.

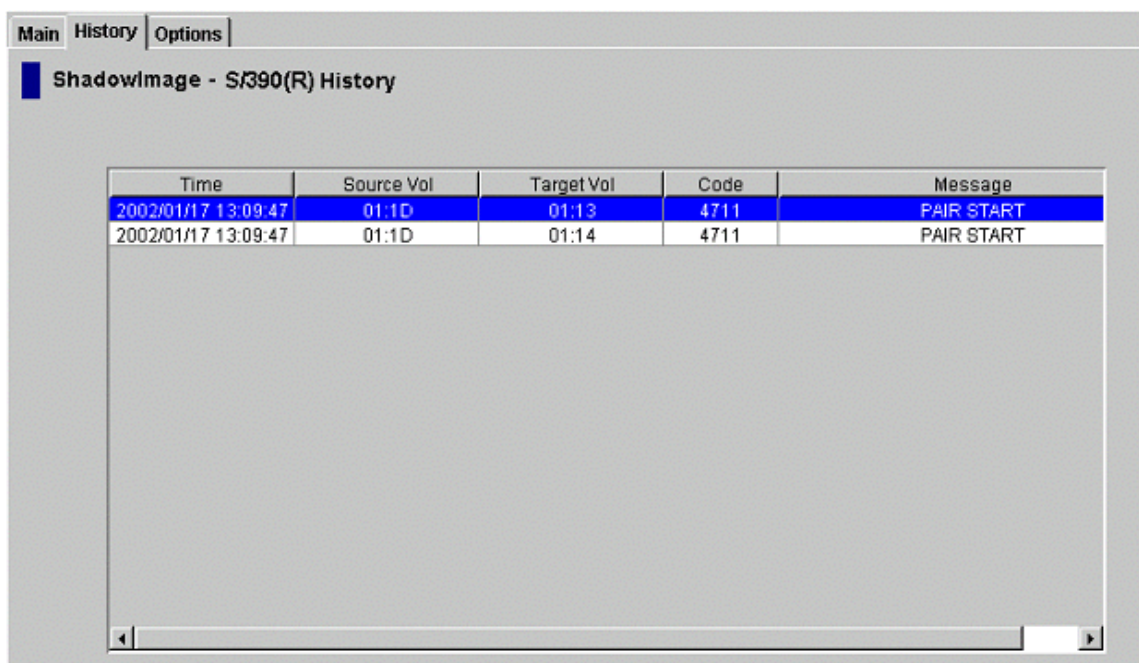


Figure 108 History window

The **ShadowImage History** box displays the following information:


- SI390 pair activity listed by: date and time, S-VOL and T-VOL ID (CU:LDEV), SI390 code and message (see [Table 75](#)). The **Time** button sorts the list by date and time. The **Source Vol** and **Target Vol** buttons sort the list by S-VOL or T-VOL. The **Code** button sorts by code number. The **Message** button sorts according to message type.
- The **Refresh** button () updates all information on the History window.

Table 75 ShadowImage status and history reference codes and messages

Code	Message	Description
4710 - 471F	DUPLEX START	The SI390 initial copy operation started.
4720 - 472F	DUPLEX END	The SI390 initial copy operation ended and the pair status changed to <i>Duplex</i> .
4730 - 473F	SPLIT START	The SI390 split operation started and the pair status changed to <i>SP-Pend</i> or <i>V-Split</i> .
4740 - 474F	SPLIT END	The SI390 split operation ended and the pair status changed to <i>Split</i> .

Table 75 ShadowImage status and history reference codes and messages (continued)

Code	Message	Description
4750 - 475F	RESYNC START RESYNC-R START	The SI390 resync operation started and the pair status changed to <i>Resync</i> or <i>Resync-R</i> .
4760 - 476F	RESYNC END RESYNC-R END	The SI390 resync operation ended and the pair status changed to <i>Duplex</i> .
4774	F-COPY START	The ShadowImage - FlashCopy operation started.
4775	F-COPY END	The ShadowImage - FlashCopy operation ended normally.
4776	F-COPY DELETE	The ShadowImage - FlashCopy delete operation was performed.
47A0 - 47AF	PENDING WARNING END	A copy ended with a warning.
47B0 - 47BF	PENDING ABNORMAL END (SVOL BLOCKADE)	A copy ended abnormally due to S-VOL blockade.
47C0 - 47CF	PENDING ABNORMAL END (TVOL BLOCKADE)	A copy ended abnormally due to T-VOL blockade.
47D0 - 47DF	PENDING ABNORMAL END	A copy ended abnormally (reason other than above).
47E7	COMPULSION PAIR SUSPEND	A pair was suspended compulsorily.
4B00 - 4B0F	F-COPY ABNORMAL END	The ShadowImage - FlashCopy operation ended abnormally.

Table 76 FlashCopy Mirror Version 2 status and history reference codes and messages

Code	Message	Description
0010	COPY STARTED(FC)	The FlashCopy Mirror Version 2 initial copy operation started.
0019	INITIALIZE STARTED(FC)	The FlashCopy Mirror Version 2 initialization process started.
0020	COPY ENDED	The FlashCopy Mirror Version 2 initial copy operation ended.
0022	NOCOPY RELATION DELETED(FC)	The FlashCopy Mirror Version 2 pair in NOCOPY mode was withdrawn by the FCWITHDR command.
0023	NOCOPY RELATION ESTABLISHED(FC)	The FlashCopy Mirror Version 2 pair was established in NOCOPY mode.
0029	INITIALIZE ENDED NORMAL(FC)	The FlashCopy Mirror Version 2 initialization process ended.
002A	COPY ENDED ABNORMAL(FC)	The FlashCopy Mirror Version 2 copy operation ended abnormally.
002F	INITIALIZE ENDED ABNORMAL(FC)	The FlashCopy Mirror Version 2 initialization process ended abnormally.

Table 76 FlashCopy Mirror Version 2 status and history reference codes and messages (continued)

Code	Message	Description
0030	COPY STARTED AFTER MODE CHANGED(FC)	The FlashCopy Mirror Version 2 copy operation started after the FlashCopy Mirror Version 2 pair changed to copy mode.
003A	DELETED BY SM VOLATILIZING(FC)	The FlashCopy Mirror Version 2 pair was withdrawn due to volatilization of the shared memory.
003B	SUSPENDED(FC)	The FlashCopy Mirror Version 2 pair was suspended due to error or failure.

Setting ShadowImage Options

You can set options for SI390 on the Options window.

To display the Options window, click the **Options** tab. From the Options window, select and/or clear the check boxes to set options.

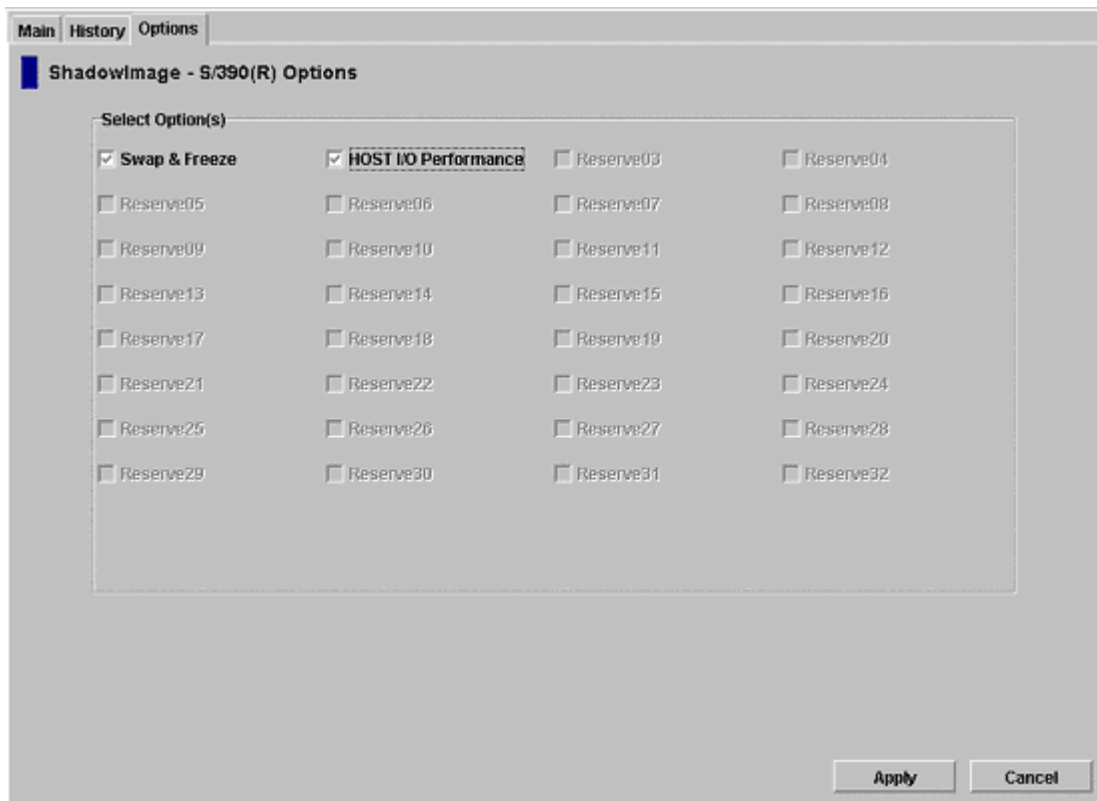


Figure 109 Options window

The **Select Option(s)** box displays the check boxes of the SI390 options. For more information about the supported options, refer to “[ShadowImage Options](#)” on page 243.

To set an SI390 option:

1. From ShadowImage, click the **Options** tab to display the Options window. When the Options window is opened, it shows the current status of the option.
2. Select the check box next to each option you want to set. If you do not want to set any of the options, clear all of the check boxes in the **Select Option(s)** box.
3. Select **Apply**. You can now perform an SI390 operation with the specified option.

CTG Window

The CTG window displays the information about the selected consistency groups of the connected XP disk array. A consistency group (CTG or CT Group) is a set of volume pairs defined by the host command.



NOTE: The **CTG** tab and its features are available only if the XP disk array has firmware version 21.07.04 or later installed.

To display the CTG window, click the **CTG** tab.

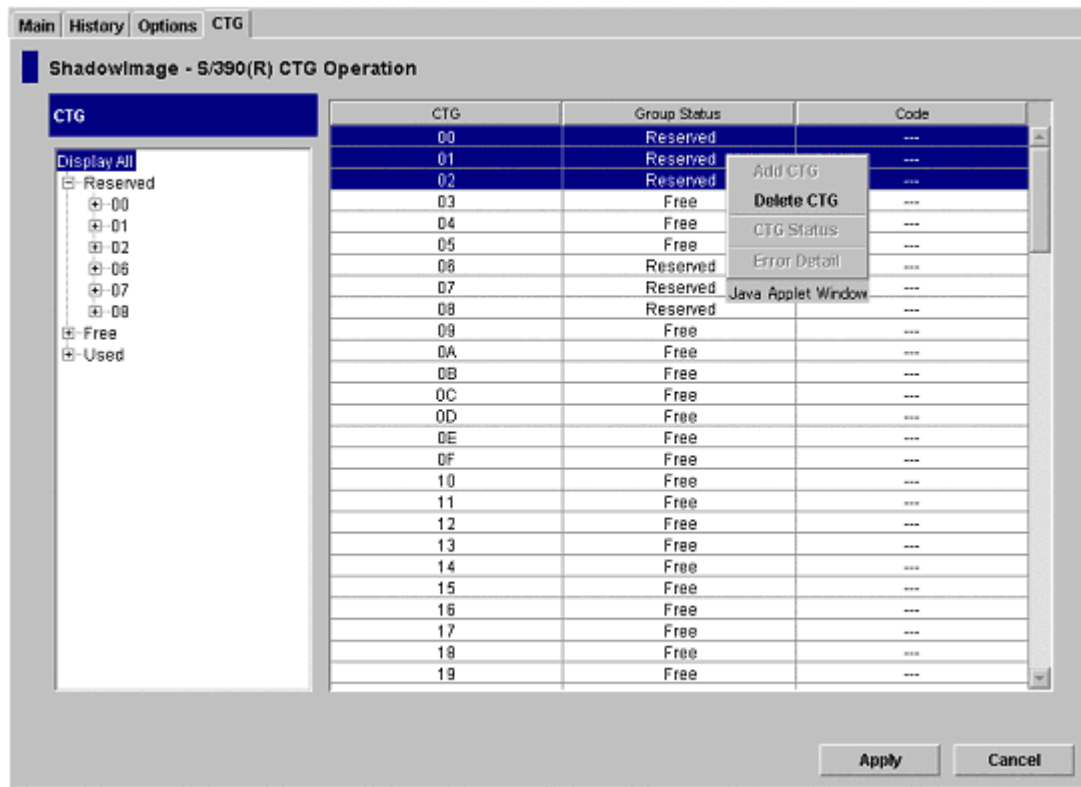


Figure 110 CTG window

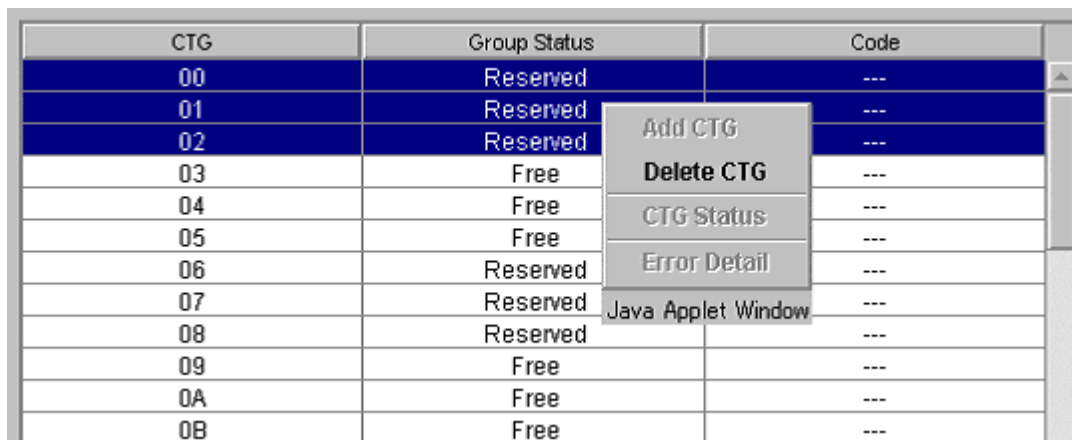
The CTG window contains the following items:

- Use the **Tree View** box, on the left of the window, to select the status (Reserved, Free or Used) or the registered ID of the consistency group that you want to display in the CTG List box. To display all the consistency groups, select **Display All** at the top of the Tree View box.
- The **CTG List** box, on the right side of the window, displays all the consistency groups selected in the Tree View box. You can sort the consistency groups by CTG, Group Status, and Code.
- The **Apply** button performs the SI390 operations displayed in the CTG List box. If an error occurs during the operation, the consistency group or groups that the system failed to perform the intended operation will remain in the CTG List box and the error code for each failed operation will be displayed under the Code column.
- The **Cancel** button cancels all the ongoing operations specified in the CTG List box.

To perform CTG operations for the consistency group, select a consistency group in the CTG List box, right-click to display the pop-up menu commands (**Add CTG**, **Delete CTG**, **CTG Status**, and **Error Detail**), and then click the appropriate command (see “[The CTG List Box](#)” on page 282).

The CTG List Box

The CTG List box displays CTG-related information based on the options you select in the Tree View box.



CTG	Group Status	Code
00	Reserved	---
01	Reserved	---
02	Reserved	---
03	Free	---
04	Free	---
05	Free	---
06	Reserved	---
07	Reserved	---
08	Reserved	---
09	Free	---
0A	Free	---
0B	Free	---

Figure 111 CTG List Box

The CTG List box contains the following items:

- **CTG:** The registered ID of each consistency group.
- **Group Status:** The current status of each consistency group. Each consistency group is set to one of the three types of status:
 - **Free:** The consistency group is available for use.
 - **Reserved:** The consistency group is set, but the volume pairs are not registered yet.
 - **Used:** The consistency group is set and the volume pairs are already registered.
- **Code:** The error code in case the system fails to apply the setting successfully when you click **Apply**. For more information about the failed operation, right-click and click the **Error Detail** command from the pop-up menu.

The following table shows the commands in the pop-up menu that you can use to perform CTG operation to one or more consistency groups of your preference in the CTG List box.

Table 77 List of pop-up menu commands for CTG operation

Command	Feature
Add CTG	Sets the reserve attribute for each CTG selected in the CTG List box.
Delete CTG	Resets the reserve attribute for the CTG(s) selected in the CTG List box.
CTG Status	Opens the CT Group Status window that displays the information about the selected consistency group.
Error Detail	Opens the Error window that displays the error code and error message describing the failed operation.

The CT Group Status Window

The CT Group Status window displays the information about the status of the selected consistency groups.

To open the CT Group Status window, select a consistency group in the CTG List box, right-click, and then select the CTG Status command.

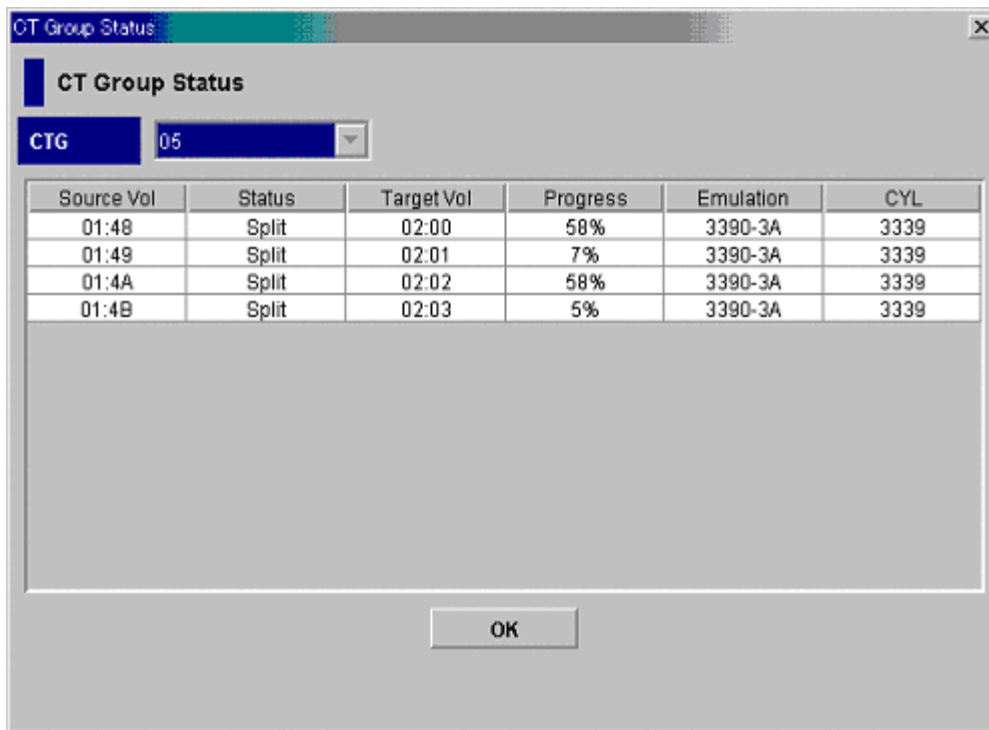


Figure 112 CT Group Status window

The CT Group Status window contains the following items:

- Use the **CTG** list to select a consistency group and display information about it in the Pair list box.
- The **Pair List** box displays the following registered pair-related information of the consistency group selected in the **CTG** list:
 - **Source Vol**: The source volume (S-VOL). The left of the colon (:) shows the CU image. The right of the colon (:) shows the ID of the logical device (LDEV).
 - **Status**: The status of the pair.
 - **Target Vol**: The target volume (T-VOL). The left of the colon (:) shows the CU image. The right of the colon (:) shows the ID of the logical device (LDEV).
 - **Progress**: The rate of copying in progress.
 - **Emulation**: The emulation type.
 - **CYL**: The number of volume cylinders.
 - **CLPR (S)**: The S-VOL's cache logical partition.
 - **CLPR (T)**: The T-VOL's cache logical partition.
- The **OK** button closes the CT Group Status window.

Setting the Reserve Attribute of a Consistency Group

Use the Add CTG command to set the reserve attribute of one or more consistency groups selected in the CTG List box.

To set the reserve attribute of one or more consistency groups:

1. From the CTG window, click the CTG Status or CTG in the Tree View box. Confirm that the information of the consistency group that you have just selected is displayed in the CTG List box.
2. Select the consistency group that you want to set the reserve attribute, right-click to display the pop-up menu, and then click **Add CTG**.
3. Repeat the previous steps for each consistency group you want to set.
4. From the CTG window, click **Apply** to set the reserve attribute.

Resetting the Reserve Attribute of a Consistency Group

Use the Delete CTG command to reset the reserve attribute of one or more consistency groups selected in the CTG List box.

To reset the reserve attribute of one or more consistency groups:

1. From the CTG window, click the consistency group or its status displayed in the Tree View box. Confirm that the information of the consistency group that you have just selected is displayed in the CTG List box.
2. Select the consistency group that you want to reset the reserve attribute, right-click to display the pop-up menu, and then click **Delete CTG**.
3. Repeat the previous steps for each consistency group you want to reset.
4. From the CTG window, click **Apply** to reset the reserve attribute.

Using PPRC Commands for ShadowImage

SI390 supports both TSO PPRC commands and ICKDSF PPRCOPY commands to perform operations from the zSeries and S/390 host system.

PPRC (Peer-to-Peer Remote Copy) is software for the mainframe host system provided by IBM. This user guide calls the TSO PPRC command and ICXKDSF PPRCOPY command *PPRC command*.

PPRC Command Support

The following table lists and describes the PPRC commands supported by SI390. [Table 79](#) on page 285 lists and describes the TSO command parameters supported by SI390. [Table 80](#) on page 289 lists and describes the ICKDSF command parameters supported by SI390.

Table 78 PPRC commands

SI390 Command View Operation	TSO Command	ICKDSF Command	Function	Restrictions
Set Reserve Attribute (reserve)	Not required	Not required	Sets the reserve attribute of the specified volume.	The specified volume must be <i>simplex</i> and offline to host.
Reset Reserve Attribute (unreserve)	Not required	Not required	Resets reserve attribute of the specified volume.	The specified volume must be <i>simplex</i> .
Add Pair (duplex request)	CESTPAIR	PPRCOPY ESTPAIR	Adds a pair, starts initial copy operation.	The specified volume must <i>simplex</i> .

Table 78 PPRC commands (continued)

SI390 Command View Operation	TSO Command	ICKDSF Command	Function	Restrictions
Add and Split Pair	CESTPAIR	PPRCOPY ESTPAIR	Adds and simultaneously splits a pair.	The specified volume must be <i>simplex</i> .
Quick Split Pair	CSUSPEND	PPRCOPY SUSPEND	Splits a pair, starts quick split operation.	The specified volume must be <i>duplex</i> or <i>pending</i> .
Steady Split Pair	CSUSPEND	PPRCOPY SUSPEND	Splits a pair, starts steady split operation.	The specified volume must be <i>duplex</i> or <i>pending</i> .
Normal Resync Pair	CESTPAIR	PPRCOPY ESTPAIR	Resynchronizes a pair, starts normal resync.	The specified volume must be <i>split</i> , <i>V-split</i> or <i>suspended</i> .
Quick Resync Pair	CESTPAIR	PPRCOPY ESTPAIR	Resynchronizes a pair, starts quick resync.	The specified volume must be <i>split</i> , <i>V-split</i> or <i>suspended</i> .
Reverse Resync Pair	CESTPAIR	PPRCOPY ESTPAIR	Resynchronizes a pair, starts reverse resync.	The specified volume must be <i>split</i> .
Quick Restore Pair	CESTPAIR	PPRCOPY ESTPAIR	Resynchronizes a pair, starts quick restore.	The specified volume must be <i>split</i> .
Delete Pair (simplex request)	CDELPAR	PPRCOPY DELPAIR	Deletes a pair, changes status to simplex.	The specified volume must be other than <i>simplex</i> .
Suspend Pair	Not available ¹	Not available ¹	Stops update copy operations.	The specified volume must be other than <i>simplex</i> .
Detail (the Detail window), the History window.	CQUERY	PPRCOPY QUERY	Displays detailed pair status information.	None.

1. The SI390 suspend operations cannot be requested using PPRC commands. The CSUSPEND/PPRCOPY SUSPEND commands execute split operations on SI390 pairs.

Table 79 TSO command parameters

Command	Parameter	Description
CESTPAIR	DEVN	Device number.
	PRIM	Primary volume (S-VOL): SSID, serial number, channel connection address, CU number (only for the DKC emulation type 2105). You can set an additional parameter corresponding to each request instead of a serial number.

Table 79 TSO command parameters (continued)

Command	Parameter	Description
		<p>(1) For an Add and Split request (refer to "Adding and Splitting Pairs" on page 272), the parameter is MSF00. This request is valid for MODE(COPY) only. The parameter locations and descriptions are as follows:</p> <p>Byte 0-6: Fixed value (xF0*7)</p> <p>Byte 7: Indication of MRCF. 'M' = MRCF ← Distinguishes SI390 from TC390.</p> <p>Byte 8: Subcode-1. 'S' = Split ← Requests simultaneous add and split.</p> <p>Byte 9: Subcode-2. 'F' = Fast Mode ← Requests quick split.</p> <p>Byte 10-11: Not used (xF0*2)</p>
		<p>(2) For a Quick Resync request, the parameter is MRFO0. This request is valid for MODE(RESYNC) only. The parameter locations and descriptions are as follows:</p> <p>Byte 0-6: Fixed value (xF0*7)</p> <p>Byte 7: Indication of MRCF. 'M' = MRCF ← Distinguishes SI390 from TC390.</p> <p>Byte 8: Subcode-1. 'R' = Resync ← Distinguishes resync from add.</p> <p>Byte 9: Subcode-2. 'F' = Fast Mode ← Requests quick resync.</p> <p>Byte 10-11: Not used (xF0*2)</p>
		<p>(3) For a Quick Restore request, the parameter is MRQ00. This request is valid for MODE(RESYNC) only. The parameter locations and descriptions are as follows:</p> <p>Byte 0-6: Fixed value (xF0*7)</p> <p>Byte 7: Indication of MRCF. 'M' = MRCF ← Distinguishes SI390 from TC390.</p> <p>Byte 8: Subcode-1. 'R' = Resync ← Distinguishes resync from add.</p> <p>Byte 9: Subcode-2. 'Q' = Quick Mode ← Requests quick restore.</p> <p>Byte 10-11: Not used (xF0*2)</p>
		<p>(4) For a Reverse Resync request, the parameter is MRR00. This request is valid for MODE(RESYNC) only. The parameter locations and descriptions are as follows:</p> <p>Byte 0-6: Fixed value (xF0*7)</p> <p>Byte 7: Indication of MRCF. 'M' = MRCF ← Distinguishes SI390 from TC390.</p> <p>Byte 8: Subcode-1. 'R' = Resync ← Distinguishes resync from add.</p> <p>Byte 9: Subcode-2. 'R' = Reverse Resync ← Requests reverse resync.</p> <p>Byte 10-11: Not used (xF0*2)</p> <p>If you set a parameter other than the above parameters, the command will be rejected.</p>

Table 79 TSO command parameters (continued)

Command	Parameter	Description
		<p>(5) For an At-Time Split Duplex request, the parameter is MAnnO. This request is valid for MODE(COPY) only. The parameter locations and descriptions are as follows:</p> <p>Byte 0-6: fixed value (xF0*7)</p> <p>Byte 7: Indication of MRCF. 'M' = MRCF ← Distinguishes SI390 from TC390.</p> <p>Byte 8: Subcode-1. 'A' = At-Time Split ← Distinguishes at-time split from add.</p> <p>Byte 9-10: Consistency group ID. 'nn' = Consistency group ID specified hexadecimally ← Requests at-time split duplex.</p> <p>Byte 11: Not used (xF0)</p>
		<p>(6) For an At-Time Split Resync request, the parameter is MAnnO. This request is valid for MODE(RESYNC) only. The parameter locations and descriptions are as follows:</p> <p>Byte 0-6: fixed value (xF0*7)</p> <p>Byte 7: Indication of MRCF. 'M' = MRCF ← Distinguishes SI390 from TC390.</p> <p>Byte 8: Subcode-1. 'A' = At-Time Split ← Distinguishes at-time split from add.</p> <p>Byte 9-10: Consistency group ID. 'nn' = Consistency group ID specified hexadecimally ← Requests at-time split resync.</p> <p>Byte 11: Not used (xF0)</p>
	SEC	Secondary volume (T-VOL): SSID, serial number, channel connection address, CU number (only for the DKC emulation type 2105).
	MODE	<p>COPY = Initial full-volume copy.</p> <p>NOCOPY = Same as COPY.</p> <p>RESYNC = Re-establish a split or suspended volume pair.</p>
	PACE	<p>For DKC emulation type 2105: Always medium.</p> <p>For others: 1 (slow), other than 1 (medium).</p>
	CRIT	Not applicable.
	MSGREQ	<p>YES = Applicable.</p> <p>NO = Not applicable.</p>
	ONLINSEC	<p>YES = Does not check path group.</p> <p>NO = Checks path group.</p> <p>CU number or this parameter is valid only for the DKC emulation type 2105.</p> <p>For MODE (COPY), the path group for the T-VOL is checked. For Quick Restore or Reverse Resync request is made in MODE (RESYNC), the path group for both the primary volume (S-VOL) and target volume (T-VOL) is checked.</p>
CSUSPEND	DEVN	Device number.

Table 79 TSO command parameters (continued)

Command	Parameter	Description
	PRIM	<p>Primary volume (S-VOL): SSID, serial number, channel connection address, CU number (only for the DKC emulation type 2105).</p> <p>You can set an additional parameter corresponding to each request instead of a serial number. For a steady split request, the parameter is MPS00. This request is valid for steady split. The parameter locations and descriptions are as follows:</p> <p>Byte 0-6: Fixed value (xF0*7)</p> <p>Byte 7: Indication of MRCF. 'M' = MRCF ← Distinguishes SI390 from TC390.</p> <p>Byte 8: Subcode-1. 'P' = SPLIT</p> <p>Byte 9: Subcode-2. 'S' = Steady Split ← Requests steady split.</p> <p>Byte 10-11: Not used (xF0*2)</p> <p>If you set a parameter other than the above parameters, the command will be rejected.</p>
	SEC	Secondary volume (T-VOL): SSID, serial number, channel connection address, CU number (only for the DKC emulation type 2105).
	PRIMARY	Not applicable.
	QUIESCE	<p>For information on the QUIESCE parameter, see "CSUSPEND QUIESCE Parameter" on page 298.</p> <p>The parameter is valid only for the DKC emulation type 3390.</p>
CDELPAIR	DEVN	Device number.
	PRIM	<p>Primary volume (S-VOL): SSID, serial number, channel connection address, CU number (only for the DKC emulation type 2105).</p> <p>Among them, the following shows the additional parameters that can be set according to the requests made in replacement of the serial number.</p> <p>For an At-Time Split Delete request, the parameter is MAnn0. The parameter locations and descriptions are as follows:</p> <p>Byte 0-6: fixed value (xF0*7)</p> <p>Byte 7: Indication of MRCF. 'M' = MRCF ← Distinguishes SI390 from TC390.</p> <p>Byte 8: Subcode-1. 'A' = At-Time Split ← Distinguishes at-time split from add.</p> <p>Byte 9-10: Consistency group ID. 'nn' = Consistency group ID specified hexadecimally ← Requests at-time split delete.</p> <p>Byte 11: Not used (xF0)</p>
	SEC	Secondary volume (T-VOL): SSID, serial number, channel connection address, CU number (only for the DKC emulation type 2105).
CQUERY	DEVN	Device number.
	PATHS	Not applicable.
CRECOVER		CRECOVER is not used for SI390.
CGROUP		CGROUP is not used for SI390.

Table 80 ICKDSF command parameters

Command	Parameter	Description
ESTPAIR	DDNAME | SYSNAME | UNITADDRESS	DDNAME = <i>dname</i> = JCL statement identifying the volume. SYSNAME = <i>sysxxx</i> = SYSNAME in the ASSGN system control statement. UNITADDRESS = <i>ccuu</i> = device number.
	PRI	Primary volume (S-VOL): SSID, serial number, channel connection address. You can set an additional parameter corresponding to each request instead of a serial number.
		(1) For an Add and Split request (refer to "Adding and Splitting Pairs" on page 272), the parameter is MSF00 . This request is valid for MODE(COPY) only. The parameter locations and descriptions are as follows: Byte 0-6: Fixed value (xFO*7) Byte 7: Indication of MRCF. 'M' = MRCF ← Distinguishes SI390 from TC390. Byte 8: Subcode-1. 'S' = Split ← Requests simultaneous add and split. Byte 9: Subcode-2. 'F' = Fast Mode ← Requests quick split. Byte 10-11: Not used (xFO*2)
		(2) For a Quick Resync request, the parameter is MRFO0 . This request is valid for MODE(RESYNC) only. The parameter locations and descriptions are as follows: Byte 0-6: Fixed value (xFO*7) Byte 7: Indication of MRCF. 'M' = MRCF ← Distinguishes SI390 from TC390. Byte 8: Subcode-1. 'R' = Resync ← Distinguishes resync from add. Byte 9: Subcode-2. 'F' = Fast Mode ← Requests quick resync. Byte 10-11: Not used (xFO*2)
		(3) For a Quick Restore request, the parameter is MRQ00 . This request is valid for MODE(RESYNC) only. The parameter locations and descriptions are as follows: Byte 0-6: Fixed value (xFO*7) Byte 7: Indication of MRCF. 'M' = MRCF ← Distinguishes SI390 from TC390. Byte 8: Subcode-1. 'R' = Resync ← Distinguishes resync from add. Byte 9: Subcode-2. 'Q' = Quick Mode ← Requests quick restore. Byte 10-11: Not used (xFO*2)

Table 80 ICKDSF command parameters (continued)

Command	Parameter	Description
		<p>(4) For a Reverse Resync request, the parameter is MRR00. This request is valid for MODE(RESYNC) only. The parameter locations and descriptions are as follows:</p> <p>Byte 0-6: Fixed value (xF0*7)</p> <p>Byte 7: Indication of MRCF. 'M' = MRCF ← Distinguishes SI390 from TC390.</p> <p>Byte 8: Subcode-1. 'R' = Resync ← Distinguishes resync from add.</p> <p>Byte 9: Subcode-2. 'R' = Reverse Resync ← Requests reverse resync.</p> <p>Byte 10-11: Not used (xF0*2)</p> <p>If you set a parameter other than the above parameters, the command will be rejected.</p>
	SEC	Secondary volume (T-VOL): SSID, serial number, channel connection address.
	MODE	<p>COPY = Initial full-volume copy.</p> <p>NOCOPY = Same as COPY.</p> <p>RESYNC = Re-established a split or suspended volume pair.</p>
	PACE	<p>For DKC emulation type 2105: Always medium.</p> <p>For others: 1 (slow), other than 1 (medium).</p>
	CRIT	Not applicable.
ESTPAIR	MSGREQ	<p>YES = Applicable.</p> <p>NO = Not applicable.</p>
	LSS	Primary volume CU number, secondary volume CU number (only for the DKC emulation type 2105).
SUSPEND	DDNAME | SYSNAME | UNITADDRESS	<p>DDNAME = dname = JCL statement identifying the volume.</p> <p>SYSNAME = sysxxx = SYSNAME in the ASSGN system control statement.</p> <p>UNITADDRESS = ccuu = device number.</p>
	PRI	<p>Primary volume (S-VOL): SSID, serial number, channel connection address.</p> <p>You can set an additional parameter corresponding to each request instead of a serial number. For a steady split request, the parameter is MPS00. This request is valid for steady split. The parameter locations and descriptions are as follows:</p> <p>Byte 0-6: Fixed value (xF0*7)</p> <p>Byte 7: Indication of MRCF. 'M' = MRCF ← Distinguishes SI390 from TC390.</p> <p>Byte 8: Subcode-1. 'P' = SPLIT</p> <p>Byte 9: Subcode-2. 'S' = Steady Split ← Requests steady split.</p> <p>Byte 10-11: Not used (xF0*2)</p> <p>If you set a parameter other than the above parameters, the command will be rejected.</p>

Table 80 ICKDSF command parameters (continued)

Command	Parameter	Description
	SEC	Secondary volume (T-VOL): SSID, serial number, channel connection address.
	PRIMA	Not applicable.
	QUIESCE	For information on the QUIESCE parameter, see " CSUSPEND QUIESCE Parameter " on page 298. (Only for the DKC emulation type 2105)
	LSS	Primary volume CU number, secondary volume CU number (only for the DKC emulation type 2105).
DELPAIR	DDNAME | SYSNAME | UNITADDRESS	DDNAME = dname = JCL statement identifying the volume. SYSNAME = sysxxx = SYSNAME in the ASSGN system control statement. UNITADDRESS = ccuu = device number.
	PRI	Primary volume (S-VOL): SSID, serial number, channel connection address.
	SEC	Secondary volume (T-VOL): SSID, serial number, channel connection address.
	LSS	Primary volume CU number, secondary volume CU number (only for the DKC emulation type 2105).
QUERY	DDNAME | SYSNAME | UNITADDRESS	DDNAME = dname = JCL statement identifying the volume. SYSNAME = sysxxx = SYSNAME in the ASSGN system control statement. UNITADDRESS = ccuu = device number.
	PATHS	Not applicable.
RECOVER		PPRCOPY RECOVER is not used for SI390.

PPRC Restrictions

[Table 81](#) lists and describes the restrictions for using PPRC commands with SI390 volumes. [Table 82](#) lists the conditions for accepting TSO/ICKDSF commands.

Table 81 Restrictions for PPRC commands

Command/Parameter	Restriction	Error Report
ESTPAIR Command SUSPEND Command	Do not issue ESTPAIR or SUSPEND command to a PENDING device.	PPRC PENDING STATUS CC = 12
RECOVER Command	Recovery commands are not valid because SI390 pairs are constructed within the same XP128/XP1024/XP12000. If a recovery command is used by mistake, the result is the same as a delete pair command, except when VOLID is specified.	PPRC PENDING STATUS CC = 4
PRIMARY Parameter	SI390 does not support use of the primary parameter within the SUSPEND command.	SI390 ignores this parameter.

Table 81 Restrictions for PPRC commands (continued)

Command/Parameter	Restriction	Error Report
MSGREQ Parameter	<p>This parameter cannot be used for ICKDSF when the volume specified as the S-VOL or T-VOL is used for TC 390.</p> <p>When the volume specified as the S-VOL is used for TC390, check the pair status by executing the QUERY command to the T-VOL.</p> <p>When the volume specified as the T-VOL is used for TC390, check the pair status by executing the QUERY command to the S-VOL.</p>	The ICKDSF job ends abnormally (CC=12)
QUIESCE Parameter	<p>This parameter cannot be used if the DKC emulation type is 2105.</p> <p>To use this parameter, ensure that the DKC emulation type is 3990.</p>	<p>For TSO, this parameter is ignored.</p> <p>For ICKDSF, the job ends abnormally (CC=12)</p>
Set Path	Not needed for SI390.	SI390 ignores this parameter.

Table 82 Accepting PPRC commands

TSO PPRC Command	ICKDSF PPRCOPY Command	Issued to S-VOL	Issued to T-VOL
CESTPAIR	ESTPAIR	OK	Not accepted
CESTPAIR with MODE(RESYNC)	ESTPAIR with MODE(RESYNC)	OK	Not accepted
CSUSPEND	SUSPEND	OK	Not accepted
CDELPAIR	DELPAIR	OK	Not accepted
CQUERY	QUERY	OK	OK

PPRC Commands with ShadowImage and TrueCopy

Both SI390 and TC390 support PPRC commands. The user must ensure that commands are being executed by the correct program against the correct volumes. A PPRC command issued to the XP128/XP1024/XP12000 will be executed by SI390 against SI390 pairs if all of the following conditions are met. If any of these conditions is not met, the PPRC command will be executed by TC390 against TC390 pairs.

1. The SI390 feature and software must be installed and enabled on the XP128/XP1024/XP12000.
2. The serial numbers of the S-VOL and the T-VOL must be the same.
 - a. If you enter different serial numbers for an existing S-VOL and T-VOL, the command will fail.
 - b. If you enter different serial numbers and the specified SI390 pair does not exist, the command will be executed by TC390.
3. If the XP128/XP1024/XP12000 contains TC390 pairs, at least one SI390 pair must exist before the command is issued.
 - a. If the XP128/XP1024/XP12000 contains both SI390 and TC390 pairs, PPRC and PPRCOPY commands that specify the same serial number for the primary (source) and secondary (target) volumes will be executed by SI390.

- b. If the XP128/XP1024/XP12000 does not contain any SI390 or TC390 pairs, PPRC and PPRCOPY commands that specify the same serial number for the primary (source) and secondary (target) volumes will be executed by SI390.
- c. If the XP128/XP1024/XP12000 contains TC390 pairs but no SI390 pairs, PPRC and PPRCOPY commands that specify the same serial number for the primary (source) and secondary (target) volumes will be executed by TC390.
- d. To start SI390 operations on an XP128/XP1024/XP12000 that already contains TC390 pairs, you must use the SI390 remote console software to add at least one SI390 pair. After an SI390 pair exists, the condition in 3(a) is met.

PSF and DEVSERV Commands

The perform subsystem function (PSF) commands key the XP128/XP1024/XP12000 to accept commands and requests from the user. The following table describes the operability of PSF commands on SI390 volumes. [Table 84](#) describes the PSF Read Subsystem Data and DEVSERV Sense Subsystem Status results for SI390 volumes.

Table 83 PSF command operability for ShadowImage volumes

Item	Operability for SI390
Device pair status.	See Table 84 .
Percent completion of the copy operation.	Not available for SI390 because the SI390 differential bitmap format is different from the TC390 differential bitmap format.
S-VOL with 2 or more T-VOLs.	Displays information for the pair having the T-VOL with the lowest LDEV ID.
Path status.	Active.
Path number.	If the volume does not also belong to a TC390 pair, 1 is displayed with TC390 info.

Table 84 PSF and DEVSERV results for ShadowImage volumes

Pair Status	PSF Read Subsystem Data		DEVSERV Sense Subsystem Status	
	S-VOL	T-VOL	S-VOL	T-VOL
Pending	PPRI-PNDG	PSEC-PNDG	PPRI-PNDG	PSEC-PNDG
Duplex	PPRIMARY	PSECONDRY	PPRIMARY	PSECONDRY
SP-Pend	PPRI-PNDG	PSEC-PNDG	PPRI-PNDG	PSEC-PNDG
V-Split	PPRI-SUSP	PSEC-SUSP	PPRI-SUSP	SIMPLEX
Split	PPRI-SUSP	PSEC-SUSP	PPRI-SUSP	SIMPLEX
Suspend	PPRI-SUSP	PSEC-SUSP	PPRI-SUSP	PSEC-SUSP
Resync	PPRI-PNDG	PSEC-PNDG	PPRI-PNDG	PSEC-PNDG



NOTE: PPRIMARY and PSECONDRY indicate that the volume is in the DUPLEX state.

Adding Pairs: CESTPAIR and PPRCOPY ESTPAIR

The CESTPAIR and PPRCOPY ESTPAIR commands are equivalent to the SI390 add pair operation (changes pair status to *pending*). The following are examples of the CESTPAIR and PPRCOPY ESTPAIR commands. These commands must be issued to the S-VOL of the pair being created and the T-VOL must be offline to the host before these commands are issued.

Example: CESTPAIR Command

```
CESTPAIR  DEVN (X 'DE80' )  PRIM (X '0080' ,30158,X '00' ) SEC (X '0080' ,30158,X '01' )
          MODE (COPY)  PACE (15)
```

Example: PPRCOPY ESTPAIR Command

```
//EPAIR      JOB
//           EXEC  PGM=ICKDSF
//SYSPRINT   DD  SYSOUT=*
//DD1        DD  UNIT=SYSDA,DISP=SHR,VOL=SER=DKDE80
//SYSIN      DD  *
PPRCOPY     ESTPAIR DDNAME(DD1) PRI(X'0080',30158,X'00') SEC(X'0080',30158,X'01')
          MODE(COPY) PACE(15)

/*
//
```

Displaying Pair Status: CQUERY, PPRCOPY QUERY, DEVSERV

The CQUERY TSO and PPRCOPY QUERY ICKDSF commands are equivalent to the SI390 pair status display and status and history functions. The following are examples of the CQUERY and PPRCOPY QUERY commands.

The DEVSERV command can also be used to display SI390 pair status. For a description of the DEVSERV command results for SI390 volumes, refer to the example of the DEVSERV command on page 296 and to [Table 84](#) on page 293.

SI390 supports multiple T-VOLs for an S-VOL, and SI390 and TC390 can both be defined for the same volume. When multiple pairs exist on one volume, the CQUERY and PPRCOPY QUERY commands can only report the status of one pair. [Table 85](#) on page 296 lists the status displayed by the host for the SI390 and/or TC390 volume pair configurations.

- If the XP128/XP1024/XP12000 contains only SI390 pairs, the CQUERY and PPRCOPY QUERY commands will report the SI390 pair status.
- If the XP128/XP1024/XP12000 contains only TC390 pairs, the CQUERY and PPRCOPY QUERY commands will report the TC390 pair status.
- If the XP128/XP1024/XP12000 contains both SI390 and TC390 pairs, the CQUERY and PPRCOPY QUERY commands will report the TC390 pair status.



NOTE: To obtain the HRMCF pair status, issue the status command to the SI390 T-VOL or use the SI390 remote console software to view the SI390 pair status.

- If an S-VOL has multiple T-VOLs, the status command will report pair status for the pair whose T-VOL has the lowest LDEV ID. To obtain the status of an SI390 pair with one of the other T-VOLs, issue the status command to the T-VOL.

Example: CQUERY Command

```

CQUERY  DEVN (X 'DE80' )
97244  13:04:38.57  TSU00684  ANTP0030I CQUERY VOLUME FORMATTED 695
695  *****
695  *                                     (PRIMARY)  (SECONDARY)  *
695  *                                     SSID CCA    SSID CCA    *
695  *DEVICE    LEVEL    STATE    PATH STATUS  SERIAL#    SERIAL#    *
695  *-----  -
695  * DE80    PRIMARY..  DUPLEX...  ACTIVE..    0080 00    0080 01    *
695  *          CRIT(NO)                                000000030158 000000030158  *
695  * PATHS SAID/DEST STATUS: DESCRIPTION                *
695  * -----  -
695  *   1    FFFF FFFF    01    PATH ESTABLISHED...    *
695  *          ---- ----    00    NO PATH                *
695  *          ---- ----    00    NO PATH                *
695  *          ---- ----    00    NO PATH                *
695  *****
97244  13:04:39.57  TSU00684  ANTP0001I CQUERY COMMAND COMPLETED. COMPLETION CODE: 00

```

00.S@000.30158

Indicates the serial number of SECONDARY.

Indicates that the current status is either in the process or completion of the split operation executed by the ATSPPLIT command.

Indicates that the pair belongs to a consistency group.

Example: PPRCOPY QUERY Command

```
//EQUERY      JOB
//              EXEC  PGM=ICKDSF
//SYSPRINT DD  SYSOUT=*
//DD1         DD  UNIT=SYSDA,DISP=SHR,VOL=SER=DKDE80
//SYSIN       DD  *
PPRCOPY      QUERY DDNAME(DD1)
/*
//

                QUERY REMOTE COPY - VOLUME

                                (PRIMARY)  (SECONDARY)
                                SSID CCA    SSID CCA
DEVICE   LEVEL      STATE      PATH STATUS  SERIAL#      SERIAL#
-----  -
DE80     PRIMARY    DUPLEX      ACTIVE      0080 00      0080 01
                                30158        30158

PATHS SAID/DEST STATUS: DESCRIPTION
-----
  1      FFFF FFFF    01      PATH ESTABLISHED...
      ----  ----    00      NO PATH
      ----  ----    00      NO PATH
      ----  ----    00      NO PATH
```



NOTE: Status display is the same as the CQUERY TSO command.

Example: DEVSERV Command

```
97244 13:04:37.39      DS P,DE80,1
97244 13:04:38.57      IEE459I 13.04.37 DEVSERV PATHS 692
                        692 UNIT DTYPE M CNT VOLSER CHPID=PATH STATUS
                        692          RTYPE SSID CFW TC DFW PIN DC-STATE CCA DCA
                        692 DE80,33903 ,0,000,DKDE80,54=+ 1C=+ D4=+ 9C=+
                        692              0080 Y YY. YY. N PPRIMARY 00 00
```

Table 85 Pair status reported by the host for volumes in multiple pairs

Number of SI390 Pairs	Number of TC390 Pairs	Status Displayed by Host
0	0	SIMPLEX
1	0	SI390 pair status
2 or more	0	SI390 pair whose T-VOL has the lowest LDEV ID
0	1	TC390 pair status
1	1	TC390 pair status
2 or more	1	TC390 pair status

Table 86 Path status displayed by the CQUERY TSO and PPRCOPY QUERY DSF commands

		CQUERY TSO Command		PPRCOPY QUERY DSF Command	
		TC390 path exists.	No TC390 path exists.	TC390 path exists.	No TC390 path exists.
SI390 S-VOL	TC390 M-VOL	Displays TC390 path	-	Displays TC390 path	-
	TC390 R-VOL	-	----	-	----
	No TC390 VOL	-	FFFF FFFF	-	FFFF FFFF
SI390 T-VOL	TC390 M-VOL	Displays TC390 path	-	Displays TC390 path	-
	TC390 R-VOL	-	-	-	-
	No TC390 VOL	-	---	-	FFFF FFFF



NOTE: The symbol “-” indicates that the combination is impossible.

Splitting Pairs: CSUSPEND and PPRCOPY SUSPEND

The CSUSPEND and PPRCOPY SUSPEND commands are equivalent to the SI390 split pair operation (changes pair status to *SP-pend*). The following are examples of the CSUSPEND command and PPRCOPY SUSPEND commands. These commands must be issued to the S-VOL and the pair status must be *duplex*. For information on the optional QUIESCE parameter for the CSUSPEND TSO command, see “[CSUSPEND QUIESCE Parameter](#)” on page 298.

Example: CSUSPEND Command

```
CSUSPEND  DEVN (X 'DE80' )  PRIM (X '0080' ,30158,X '00' ) SEC (X '0080' ,30158,X '01' )
```

Example: PPRCOPY SUSPEND Command

```
//EPAIR      JOB
//              EXEC  PGM=ICKDSF
//SYSPRINT DD  SYSOUT=*
//DD1        DD  UNIT=SYSDA,DISP=SHR,VOL=SER=DKDE80
//SYSIN      DD  *
PPRCOPY      SUSPEND DDNAME(DD1) PRI(X'0080',30158,X'00') SEC(X'0080',30158,X'01')
/*
//
```



CAUTION: The CSUSPEND QUIESCE option has been disabled by APAR OW15247 or APAR OW15248. For detailed information on the QUIESCE option, refer to either of these APARs. Check with your HP account team before using the QUIESCE option with the XP128/XP1024/XP12000. If the QUIESCE option is issued to certain volumes (for example, active SPOOL, PAGE, or CATALOG datasets, or active SYSRES volume), the attached host(s) may enter a deadlock condition and may require a storage control IML to correct the condition.

The QUIESCE parameter is used to modify the functionality of the CSUSPEND TSO command. For example, if the QUIESCE parameter is specified, the pair will be inactive and subsequent write requests to the S-VOL will be suspended by the host until the QUIESCE condition is released. You can use the QUIESCE parameter only when the pair status is duplex. If the QUIESCE parameter is not specified, subsequent write operations will be rejected and write-reserved write requests will be processed. The following table lists the requirements for using the QUIESCE parameter with SI390 pairs.

Table 87 QUIESCE parameter requirements for ShadowImage

Pair Status	QUIESCE Accepted?
Simplex	No
Pending	No
Duplex	Yes
SP-Pend	No
V-Split	No
Split	No
Resync	No
Suspend	No

If an SI390 S-VOL has more than one T-VOL, the QUIESCE parameter is effective if at least one pair is specified. Write requests at the S-VOL will start when all QUIESCE conditions are released. The following conditions cause the XP128/XP1024/XP12000 to automatically release the QUIESCE condition:

- A CSUSPEND TSO command without the QUIESCE parameter is accepted.
- A CDELPAR TSO command is accepted.
- A Delete, Suspend, or Split Pair command (from the Remote Console PC) is accepted.
- Disk array power-on-reset is executed.



NOTE: If an SI390 pair is suspended because of an internal disk array error condition, the QUIESCE option is applied. In this case, release the QUIESCE condition by deleting the pair.

SI390 and TC390 are processed independently. The CSUSPEND/QUIESCE command is effective for either the SI390 or TC390 pair specified in the command.

Resynchronizing Pairs: MODE(RESYNC) Parameter

The MODE(RESYNC) option of the CESTPAIR and PPRCOPY ESTPAIR commands is equivalent to the SI390 normal resync operation (changes pair status to *resync*). The following are examples of the CESTPAIR command with the MODE(RESYNC) parameter and the PPRCOPY ESTPAIR command with the MODE(RESYNC) parameter. These commands must be issued to the S-VOL and the pair status must be *split* or *suspend* when MODE(RESYNC) is specified.

Example: CESTPAIR with MODE(RESYNC) Parameter

```
CESTPAIR  DEVN (X 'DE80' )  PRIM (X '0080' ,30158,X '00' ) SEC (X '0080' ,30158,X '01' )
          MODE (RESYNC)  PACE (15)
```

Example: PPRCOPY ESTPAIR with MODE(RESYNC) Parameter

```
//EPAIR      JOB
//           EXEC   PGM=ICKDSF
//SYSPRINT   DD   SYSOUT=*
//DD1        DD   UNIT=SYSDA,DISP=SHR,VOL=SER=DKDE80
//SYSIN      DD   *
PPRCOPY     ESTPAIR DDNAME(DD1) PRI(X'0080',30158,X'00') SEC(X'0080',30158,X'01')
            MODE(RESYNC) PACE(15)
/*
//
```

Deleting Pairs: CDELPAIR and PPRCOPY DELPAIR

The CDELPAIR and PPRCOPY DELPAIR commands are equivalent to the SI390 delete pair operation (changes pair status to *simplex*). The following are examples of the CDELPAIR and PPRCOPY DELPAIR commands. These commands must be issued to the S-VOL.

A DELPAIR command performed when pair status is *split* enables the T-VOL to be accessed by the host. A DELPAIR command performed when pair status is other than *split* allows non-reserved T-VOLs to be accessed by the host. Reserved *simplex* volumes cannot be accessed.



CAUTION: For duplex SI390 pairs, the S-VOL and its associated T-VOL(s) are usually not identical because SI390 update copy operations are asynchronous. Therefore, if a pair is deleted with status other than *split*, the data integrity of the T-VOL cannot be guaranteed.

Example: TSO Delete Command

```
CDELPAIR  DEVN (X 'DE80' )  PRIM (X '0080' ,30158,X '00' ) SEC (X '0080' ,30158,X '01' )
```

Example: ICKDSF Delete Command

```
//EPAIR      JOB
//           EXEC   PGM=ICKDSF
//SYSPRINT   DD   SYSOUT=*
//DD1        DD   UNIT=SYSDA,DISP=SHR,VOL=SER=DKDE80
//SYSIN      DD   *
PPRCOPY     DELPAIR DDNAME(DD1) PRI(X'0080',30158,X'00') SEC(X'0080',30158,X'01')
/*
//
```

Setting and Resetting the At-Time Split Time: ATSPLIT

Use the ATSPLIT command to set or reset the time to perform the At-Time Split operation.

Table 88 Parameters of ATSPLIT command

Parameter	Description
DEVN	Use this parameter to specify the four-digit device address. When a four-digit device address is specified, an ATSPLIT command will be issued to the specified device. The specified device must be an arbitrary S-VOL belonging to the consistency group that you intend to split.
GROUP	Use this parameter to specify the ID of the consistency group with a two-digit hexadecimal number. The ID you specify must match with the ID of the consistency group where the device you specified belongs.
GENID	Use this parameter to specify the two-digit hexadecimal GenerationID. The GenerationID you specify here will be displayed as the ATQUERY command output information.
TIME	Use this parameter to specify the time you want to perform the Split operation. Specify the time in UTC (Universal Time Coordinated=GMT) and in the format of <i>hh:mm:ss</i> .
DATE	Use this parameter to specify the date you want to perform the Split operation. Specify the date in <i>yyyymmdd</i> . If you omit this parameter, the Split operation will be performed on the day the ATSPLIT command is executed. Be sure to set the time for performing the Split operation that is later than the time and date when the ATSPLIT command is executed.
NOWPLUS	Use this parameter to specify the time you want the Split operation to be performed, counting from the current time. Specify the time in <i>hh:mm:ss</i> format (using the numerals that are not bigger than 23:59:59). This parameter is valid when only one subsystem is used. When more than one subsystem is used, the time set to each subsystem may differ. If they differ, you may not gain the proper result as you expected.
ATLOCAL	Use this parameter to specify the local time (in <i>hh:mm:ss</i> format) and date (in <i>yyyymmdd</i> format) you want to perform the Split operation. For the guarantee period of the Split operation, you can specify any value that is equal or smaller than 32768 minutes.
ATGMT	Use this parameter to specify the Split time in UTC (Universal Time Coordinated=GMT) using the <i>hh:mm:ss</i> format. For the guarantee period of the Split operation, you can specify any value that is equal or smaller than 32768 minutes.
CANCEL	Use this parameter to reset the Split time that you have specified by using the ATSPLIT command. You cannot use this parameter at the same time with the TIME parameter or the NOWPLUS parameter. If you do so, your ATSPLIT command will be rejected.

Example: ATSPLIT Command

```
ATSPLIT DEVN(X'7920') DATE(20021001) TIME(22:38:50) GROUP(X'1A') GENID(X'1B')
ATSPLIT DEVN(X'7100') NOWPLUS(00:01:30) GROUP(X'01') GENID(X'1B')
ATSPLIT DEVN(X'7100') ATLOCAL(20021031,10:08:30,10) GROUP(X'05')GENID(X'1B')
ATSPLIT DEVN(X'0010') GROUP(X'10') GENID(X'1B') CANCEL
```

The purpose of the ATSPLIT command is to reserve the time that you want to perform the Split operation. The Split operation is performed at the time specified by the ATSPLIT command and not when you execute this command. To check whether the Split operation is performed at the time as specified, confirm it by executing the ATQUERY or CQUERY command.

The Split operation is performed at the time of reception of the read/write request with a time stamp that has passed the time specified as the Split time. The Split operation may be delayed in case no read/write request is issued and the Split operation, as a result, is performed as a result of timeout of the subsystem timer.

In case there is a pair in the consistency group that cannot be split completely during the Split operation, the status of this pair will remain the same as before the Split operation.

Displaying the Status of the Consistency Group: ATQUERY

The ATQUERY command is used to display the status of the consistency group.

Example: ATQUERY Command

```
ATQ091I  DEVN(X'7920')  GROUP(X'7F')  GENID(X'01')
ATQ092I  PAIRS -  INGROUP(0100),SUSP(0080),TRANS(0018),PEND(0000),
          DUPL(0002),RESYNC(0000),FAILED(0000)
ATQ093I  PRESET  STATUS: NOT SET
ATQ094I  PRESET  STATUS: SET  yyyyymmdd hhmmss - WAITING
ATQ095I  PRESET  STATUS: SET  yyyyymmdd hhmmss - TIMESTAMP TRIGGERED
ATQ096I  PRESET  STATUS: SET  yyyyymmdd hhmmss - TIMEOUT TRIGGERED
```

The meaning of each ATQUERY command example shown in the previous example is explained in the following table.

Table 89 Description of the ATQUERY command examples

Item	Description
ATQ091I	Indicates the following information hexadecimally: Device number (DEVN) ID of the consistency group (GROUP) where the specified device belongs to GenerationID (GENID)
ATQ092I	Indicates the following decimally-displayed information of the device to which the ATQUERY command is issued: Total number of pairs in the consistency group where the specified device belongs to (INGROUP) Number of pairs in the consistency group that are in the Split status (SUSP) Number of pairs in the consistency group that are currently splitting (TRANS) Number of pairs in the consistency group that are in the Pending status (PEND) Number of pairs in the consistency group that are in the Resync status (RESYNC) Number of pairs in the consistency group that changed their status to Suspend due to error (FAILED)
ATQ093I	Indicates that there is no ATSPLIT command set to specify the Split time.
ATQ094I	Indicates that there is an ATSPLIT command set to specify the Split time, but it is still not that specified time and no timeout is detected as yet.
ATQ095I	Indicates that the Split operation has started because the time reached the specified Split time.
ATQ096I	Indicates that the Split operation has started as a result of the detection of timeout.

The ATQUERY command must be issued to the T-VOL in the consistency group. If it is issued to any other volumes in the consistency group, it will be rejected.

Using ShadowImage - FlashCopy

ShadowImage - FlashCopy is functionally compatible with the IBM FlashCopy host software function. PPRC TSO commands and/or DFSMSdss commands may be used to perform ShadowImage - FlashCopy operations on the XP128/XP1024/XP12000. See ["Using ShadowImage - FlashCopy Host Commands"](#) on page 307 for further information on using PPRC TSO commands and DFSMSdss commands.

To enable the ShadowImage - FlashCopy function on the XP128/XP1024/XP12000, SI390 and ShadowImage - FlashCopy must be installed and enabled on the disk array.

Overview of ShadowImage - FlashCopy

The ShadowImage - FlashCopy function provides a fast data replication capability. This function creates a copy of an S-VOL to a T-VOL virtually or physically. When the ShadowImage - FlashCopy function is used with PPRC TSO commands or DFSMSdss commands, a relationship is established between the S-VOL and T-VOL where the T-VOL (the virtual or physical copy of the S-VOL) is available for both read and write operations.

When you establish a relationship for an ShadowImage - FlashCopy pair, you can specify a range of data to be copied, which is called the "extent." When the extent data copy is complete, the relationship ends automatically.

You can establish an ShadowImage - FlashCopy pair not only for SI390 simplex volumes, but also for SI390 S-VOL or T-VOL in the split or duplex status.

Table 90 Requirements for ShadowImage - FlashCopy

Item	Requirement
Controller emulation type	I-2105
SSID boundary setting	256-LDEV (The SSID boundary of IBM ESS is 256-LDEV.)

- When the SSID boundary is 64-LDEV, S-VOL and T-VOL must be established in the same CU image and SSID.
- When a relationship is established and the SSID boundary is changed from 256-LDEV to 64-LDEV, the SSIDs for T-VOL and S-VOL become different. Because of this condition, the relationship cannot be deleted from the host. In this case, you should delete the relationship from SI390 on the Remote Console PC.

ShadowImage - FlashCopy Pair Status

The following figure illustrates the pair status transition and the relationship between the pair status and the ShadowImage - FlashCopy operations.

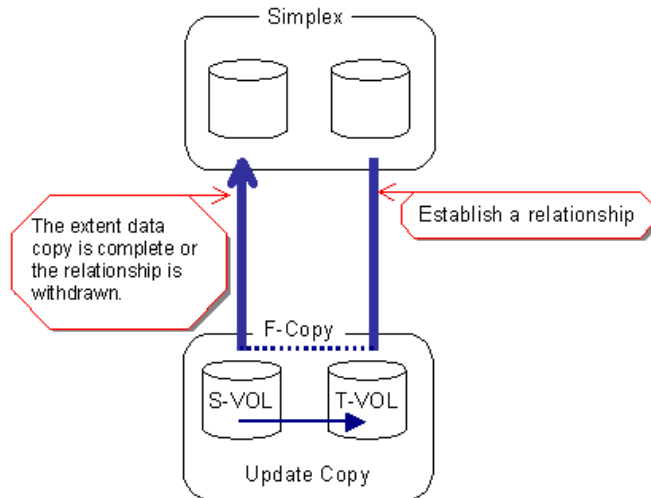


Figure 113 ShadowImage - FlashCopy pair status transition



NOTE: When the extent data copy fails, the ShadowImage - FlashCopy relationship ends automatically (the status becomes simplex) and the T-VOL is blocked.

Table 91 describes ShadowImage - FlashCopy pair status condition.

Table 91 ShadowImage - FlashCopy pair status condition

Status	Description	Host Status	S-VOL Access	T-VOL Access
F-Copy	ShadowImage - FlashCopy is requested with host commands. The S-VOL differential data is copied to the T-VOL in the background. When the NOCOPY option is specified, no background copy is performed.	S-VOL = SIMPLEX T-VOL = SIMPLEX	Read/write.	Read/write, can be varied online.

Establishing ShadowImage - FlashCopy Pairs

You can establish an ShadowImage - FlashCopy pair for an SI390 simplex volume. Table 92 shows the allowable ShadowImage - FlashCopy operations for each pair status. You can also add an ShadowImage - FlashCopy pair for SI390 S-VOL or T-VOL in the split or duplex status (see Table 93 and

Table 94). However, you cannot establish a ShadowImage - FlashCopy pair if the S-VOL already has three T-VOLs.

Table 92 Pair Status versus allowable operations

Operation	Pair Status									
	SI390									SI - FC
	Simpl.	Pend.	Dupl.	SP-Pend	V-Spl.	Spl.	Resync	Resync-R	Susp.	F-Copy
Split Pair	OK	OK	OK	x	x	x	x	x	x	x
Suspend Pair	x	OK	OK	OK	OK	OK	OK	x	OK	x
Resync Pair	x	x	x	x	OK	OK	x	x	OK	x
Reverse Copy	x	x	x	x	x	OK	x	x	x	x
Quick Restore	x	x	x	x	x	OK	x	x	x	x
Delete Pair	x	OK	OK	OK	x	OK	OK	OK	OK	OK
Establish Relationship	OK	x	x	x	x	x	x	x	x	x
Withdraw Relationship	x	x	x	x	x	x	x	x	x	OK

ShadowImage - FlashCopy adds a second layer of ShadowImage - FlashCopy pairs onto the first layer of original SI390 pairs. These two layers of pairs (L1 and L2) can create up to six copies of one original SI390 source volume (S-VOL).



NOTE: You cannot add an ShadowImage - FlashCopy L2 pair onto an ShadowImage - FlashCopy L1 pair, an SI390 L2 pair onto an SI390 L1 pair, or any third layer of pair (L3 pair) onto an L2 pair.

The following figure shows an example of combining ShadowImage - FlashCopy and SI390 pairs in the L1 and L2 pairs.

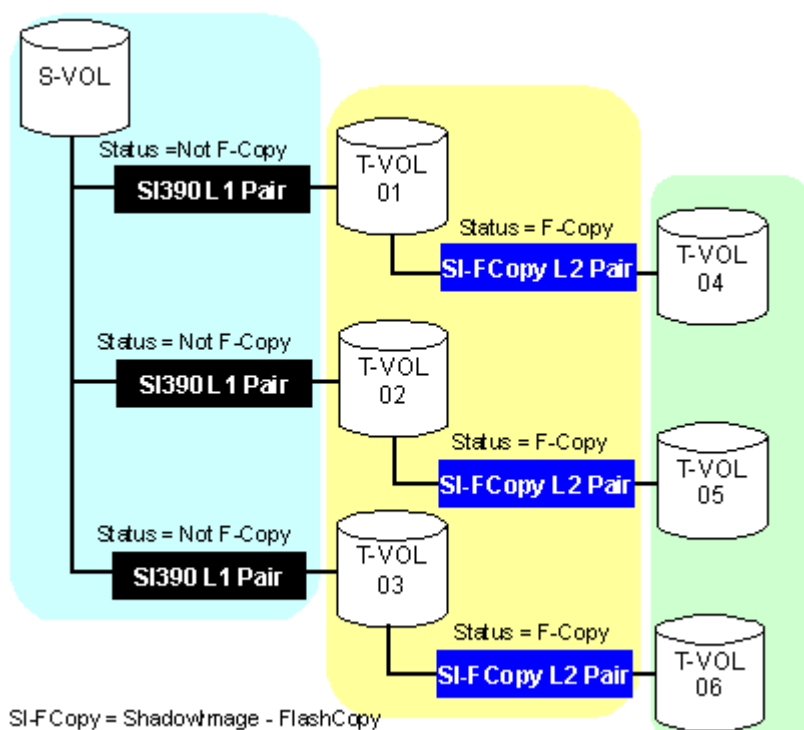


Figure 114 Possible combination of ShadowImage - FlashCopy and SI390 pairs

The following table shows the relationship between the L1 pair status and the availability of SI390 or ShadowImage - FlashCopy pair operations on the associated L2 pairs. [Table 94](#) shows the relationship between the L2 pair status and the availability of pair operations on the associated L1 pairs.

Table 93 Relationship between L1 pair status and L2 pair operations

L1 Pair Status	L2 Pair Operations						
	Add Pair	Split Pair	Resync Pair	Reverse Resync/Quick Restore	Susp.	Delete	Establish Relationship
Pending	The combination has no relationship with the ShadowImage - FlashCopy pair. You cannot perform the operation.					OK	NO
Duplex						OK	NO
SP-Pend						OK	NO
V-Split						OK	NO
Split						OK	OK
Resync						OK	NO
Resync-R						OK	NO
Suspend						OK	NO

Table 94 Relationship between L2 pair status and L1 pair operations

L2 Pair Status	L1 Pair Operations						
	Add Pair	Split Pair	Resync Pair	Reverse Resync/ Quick Restore	Susp.	Delete	Establish Relationship
F-Copy	NO	NO	NO	NO	OK	OK	NO



NOTE: You cannot create a pair that has a T-VOL shared with the S-VOL of an L1 pair.

Combining ShadowImage - FlashCopy With Other Copy Solutions

You can combine an ShadowImage - FlashCopy pair with a TC390 or XRC pair (see [Table 95](#) and [Table 96](#)).

Table 95 ShadowImage - FlashCopy and TC390 shared volume

	TC390 M-VOL	TC390 R-VOL
ShadowImage - FlashCopy S-VOL	OK	OK The TC390 pair must be suspended (status = suspend)
ShadowImage - FlashCopy T-VOL	NO	NO

The ShadowImage - FlashCopy and TC390 shared configuration is different from the IBM FlashCopy and PPRC shared configuration. For ShadowImage - FlashCopy and TC390, you cannot create the following TC390 pairs (see [Figure 115](#)):

- A TC390 pair that includes a volume functioning as both an ShadowImage - FlashCopy T-VOL and a TC390 M-VOL.

- A TC390 pair that includes a volume functioning as both an ShadowImage - FlashCopy T-VOL and a TC390 R-VOL.

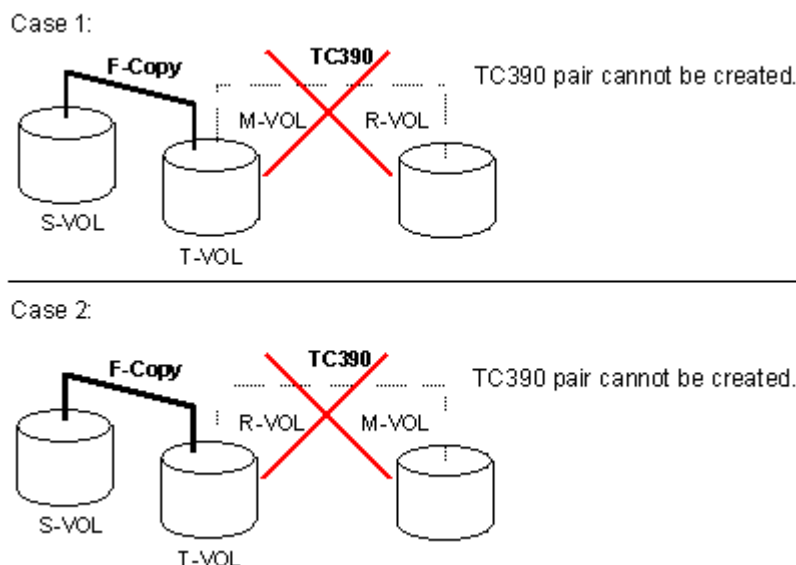


Figure 115 ShadowImage - FlashCopy and TCz: shared T-VOL and M-VOL/R-VOL (not allowed)

You cannot create a TCz pair that includes a volume functioning as both a FlashCopy Mirror T-VOL and a TCz M-VOL. You cannot create a TCz pair that includes a volume functioning as both a FlashCopy Mirror T-VOL and a TCz R-VOL.



NOTE: For IBM FlashCopy and PPRC, you can create a PPRC pair that includes a volume functioning as both a FlashCopy T-VOL and a PPRC primary volume, and a PPRC pair that includes a volume functioning as both a FlashCopy T-VOL and a PPRC secondary volume.

Table 96 ShadowImage - FlashCopy and XRC shared volume

	XRC Primary Volume	XRC Secondary Volume
ShadowImage - FlashCopy S-VOL	OK	OK
ShadowImage - FlashCopy T-VOL	NO	NO

Using ShadowImage - FlashCopy Host Commands

ShadowImage - FlashCopy supports both DFSMSdss commands and TSO PPRC commands to perform ShadowImage - FlashCopy operations from the zSeries and S/390 host system.

Before you use ShadowImage - FlashCopy, you must take the following steps:

1. Install the SI390 feature and software.
2. Install the ShadowImage - FlashCopy feature and software.
3. Change the corresponding devices offline to the host, and then change the devices online to the host again. This ensures that you have the latest device information before performing ShadowImage - FlashCopy operations. This offline/online operation is required just once.

ShadowImage - FlashCopy does not support the REMOVEFCPY parameter of ICKDSF CONTROL command. To delete the relationship of all the ShadowImage - FlashCopy pairs established in the disk array, use the SI390 main window.

DFSMSdss Command Support

ShadowImage - FlashCopy can be used by the COPYFULL command (description) through the DFSMSdss commands. When ShadowImage - FlashCopy copy is requested, DFSMSdss automatically determines whether it is an ShadowImage - FlashCopy copy request or an ordinary SI390 copy request through the host. The COPYFULL command completes within a few seconds and the ShadowImage - FlashCopy pair is established at once. ShadowImage - FlashCopy data is copied in the background and the completion of copy is not reported to the user. The following shows an example of the DFSMSdss commands.

Example: DFSMSdss Commands

```
//COPYFULL JOB.....  
/*  
//INSTIMG EXEC PGM=ADRDSSU  
//SYSPRINT DD SYSOUT=*  
//SYSUDUMP DD SYSOUT=V,OUTLIM=3000  
//SYSIN DD *  
COPY FULL INDYNAM (SORCEV) OUTDYNAM (TRGVOL) COPYVOLID  
/*
```

ShadowImage - FlashCopy can establish a relationship for one volume pair at a time. When ShadowImage - FlashCopy copy is requested for a volume pair in the F-Copy status, DFSMSdss identifies the request as an SI390 copy request through the host and performs SI390 copy operations.

The COPYVOID option is used to copy the volume serial number (VOLSER). If the COPYVOID option is specified, the volume serial number is copied to the T-VOL and the T-VOL becomes offline automatically. This COPYVOID option was necessary for SMS-managed volumes until the DUMPCONDITONING parameter was added to DFSMSdss with APAR OW 45674. If the DUMPCONDITONING parameter is specified, there is no need to copy the volume serial number for SMS-managed volumes.

When the DFSMSdss command is executed, all datasets on the source volume are copied to the T-VOL. Volume area that is not allocated as a dataset is not copied.

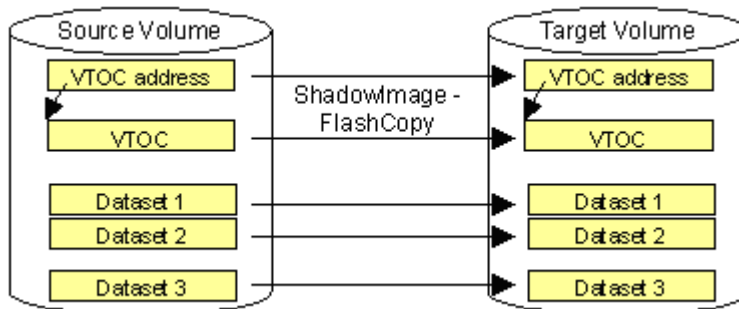


Figure 116 Copying All Datasets Using DFSMSdss Command



NOTE: You cannot specify both the COPYVOID option and DUMPCONDITONING parameter at the same time.

The following conditions cause the XP128/1024 to output the ADR935W message and end with CC = 4 (SI390 copy is performed through the host):

- The size of the T-VOL is larger than the source volume within the same CU image.
- The emulation types of the S-VOLs and T-VOLs are different within the same CU image.



NOTE: When the SSID boundary is 64-LDEV and you establish a relationship between two volumes that have the same CU image but different SSIDs, you can copy data from S-VOL to T-VOL by the host program.

TSO Command Support

The following table lists and describes the TSO commands supported by ShadowImage - FlashCopy. "PPRC TSO command parameters" on page 310 lists and describes the TSO command parameters supported by ShadowImage - FlashCopy.



NOTE: To use the following PPRC TSO commands, you must add the command names to the AUTHCMD PARM of IKJTSOxx that is a member of SYS1.PARMLIB, because the system is protected by RACF Facility.

Table 97 PPRC TSO commands

ShadowImage - FlashCopy Operation	PPRC TSO Command	Function	Restrictions
Add ShadowImage - FlashCopy Pair	FCESTABL	Establishes a relationship between the source and T-VOLs.	The specified volume must be simplex. When the SSID boundary is 64-LDEV, the S-VOL and T-VOL for ShadowImage - FlashCopy must be established in the same CU image and SSID.
Delete ShadowImage - FlashCopy Pair	FCWITHDR	Withdraws the relationship of an existing ShadowImage - FlashCopy pair.	The specified volume must have an established relationship. When the SSID boundary is 64-LDEV, S-VOL and T-VOL for ShadowImage - FlashCopy must be established in the same CU image and SSID. When S-VOL and T-VOL are in the different SSIDs, delete the relationship from the SI390 window on the Remote Console PC.
Display ShadowImage - FlashCopy Pair Status	FCQUERY	Displays detailed pair status information.	None.

Table 98 PPRC TSO command parameters

Command	Parameter	Description
FCESTABL	SDEVN	Source device number.
	TDEVN	Target device number.
	MODE	<p>COPY = Data is copied in the background. Normally, the relationship ends automatically after all of the data has been copied.</p> <p>NOCOPY = Data is not copied in the background. It is necessary to issue FCWITHDR command to delete the relationship specified with NOCOPY option. Before ShadowImage - FlashCopy read/write processing actually starts, all of the data in an accessed track of the S-VOL is copied to the T-VOL when one of the following data access occurs:</p> <ol style="list-style-type: none"> 1. Write data access to the extents of the S-VOL. 2. Write data access to the extents of the T-VOL. 3. Read data access to the extents of T-VOL. <p>The timing of ShadowImage - FlashCopy data copying is different from IBM FlashCopy. IBM FlashCopy copies data when data in either the source or T-VOL is updated.</p>
	ONLINTGT	YES = The path group is not checked.NO = The path group is checked.
	EXTENTS	Extents specify the range of copy by CCHH. Up to five extents can be specified.
FCWITHDR	SDEVN	Source device number.
	TDEVN	Target device number.
FCQUERY	DEVN	Device number.

When the TSO command (FCESTABL command) is executed, only the extents specified by the EXTENTS parameter are copied from the S-VOL to the T-VOL. For example, the following figure shows an example of copying Dataset 2 only. If the EXTENTS parameter is not specified, the entire source volume is copied to the T-VOL.

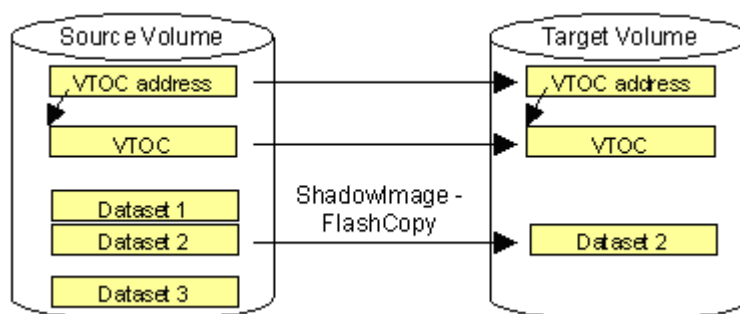


Figure 117 Copying Specified Dataset by Specifying EXTENTS Parameter Using TSO (FCESTABL) Command

To copy one or more dataset using the TSO (FCESTABL) command:

1. Check the VTOC list to confirm VTOC (including INDEX VTOC) and the address (cylinder number and header number) of the dataset(s) that you want to copy.
2. Vary the T-VOL offline.

3. Execute the FCESTABL command. You must specify the following items by the EXTENTS parameter. If you access a dataset that is not specified by the EXTENTS parameter, the operation cannot be guaranteed.
 - Dataset(s) to be copied. If you want to copy multiple datasets, you must specify the extents of all of the desired datasets.
 - VTOC address (Cylinder 0, header 0).
 - VTOC.

If the dataset(s) uses the following items, you must also specify those items by the EXTENTS parameter.

 - INDEX VTOC.
 - VSAM volume dataset of the VSAM file (SYS1.VVDS.Vxxxxxx,xxxxxx is VOLSER).
4. Change the VOLSER of the T-VOL. You must change the VOLSER of the T-VOL before varying the T-VOL online because the VOLSERs of the S-VOL and T-VOL become identical as a result of copying VTOC.
5. Vary the T-VOL online.

Adding ShadowImage - FlashCopy Pairs: FCESTABL

The following shows an example of the FCESTABL command.

Example: FCESTABL Command

```
FCESTABL SDEVN(X'DE80') TDEVN(X'DE81') MODE(COPY) ONLINTGT(YES)
EXTENTS(X'00010000' X'0100000E')
```

Deleting ShadowImage - FlashCopy Pairs: FCWITHDR

The FCESTABL command can be issued to an ShadowImage - FlashCopy pair for which a relationship has already been established. The following shows an example of the FCWITHDR command.



CAUTION: If a pair is deleted by the FCWITHDR command, the data integrity of the T-VOL cannot be guaranteed.

Example: FCWITHDR Command

```
FCWITHDR SDEVN(X'DE80') TDEVN(X'DE81')
```

Displaying ShadowImage - FlashCopy Pair Status: FCQUERY

The FCQUERY command can be used to display ShadowImage - FlashCopy pair status. The following shows an example of FCQUERY command.

Example: FCQUERY Command

```
ANTF0090IF CQUERY Formatted
DEVN SSID LSS CCA CU SERIAL STATUS
0A4D 2830 03 0D 2105 0000325476 FC . . . . . 88%
_____ 2830 03 07 2105 0000325476 FC . . . . .
```

Table 99 Status displayed by FCQUERY command

Pair Status	Description
SIMPLEX	Volume is in the simplex status.
XRC	Used by XRC source volume.
PPRC	PPRC pair.
FC xxx%	ShadowImage - FlashCopy pair. If data is being copied in the background, the copy progress (%) is also displayed.

Cautions on Switching Off the Power Supply When Using ShadowImage - FlashCopy

If you have to switch off the power supply of the disk array during ShadowImage - FlashCopy operations, make sure to complete copying for the ShadowImage - FlashCopy pair, and then switch off the power supply. If the shared memory is volatilized when you switch on the power supply again, the following conditions occur:

- The relationship of the ShadowImage - FlashCopy pair is deleted.
- The T-VOL of the ShadowImage - FlashCopy pair is blocked.

Troubleshooting

General ShadowImage Troubleshooting

If an SI390 error code or message is displayed on the Command View management station, refer to "[ShadowImage Error Window](#)" on page 313 for a description of the SI390 error codes and recommended corrective action.



NOTE: Make sure to copy the SVP configuration information onto floppy disks) using the **FD Dump Tool** and give the floppy disk(s) to HP service personnel.

The following table provides general troubleshooting instructions for SI390 operations.

Table 100 General ShadowImage troubleshooting

Error	Corrective Action
SI390 operations do not function properly.	Verify all SI390 requirements and restrictions are met. Verify the XP128/XP1024/XP12000 is powered on and fully functional (NVS, cache, DFW). Check all input values and parameters to verify that you entered the correct information on the SI390 windows (for example, P-VOL and S-VOL IDs).
The volume pairs are not displaying correctly.	Verify the correct CU image is selected.

Table 100 General ShadowImage troubleshooting (continued)

Error	Corrective Action
An SI390 error message is displayed on the Command View management station.	For a description of the error code, refer to " ShadowImage Error Window " on page 313.
There is a problem with the management station.	Save the Java log file on the management station and report to HP technical support. For Windows 2000, the Java log file is in the following place: C:\Documents and Settings\login user ID\plugin131.trace Exit the Web browser, close all other applications, and then restart the PC. If the problem persists, verify that the PC's operating system and LAN hardware and software are properly configured.
The SI390 pair status is incorrect (or unexpected).	The pair may have been suspended or deleted from the UNIX/PC server host using RAID Manager. If not, the XP128/XP1024/XP12000 detected an error condition during SI390 operations. Check the SVP error log. If necessary, call HP technical support for assistance.
There is a pinned track on an SI390 volume.	If a pinned track occurs on an SI390 S-VOL or T-VOL, the XP128/XP1024/XP12000 will suspend the pair. Contact your HP account support representative for assistance in recovering pinned tracks.
Only the Exit and Refresh buttons are effective when accessing the SVP from the Command View management station.	The SVP might not be ready or perform some write processes from the other system. Wait for a while, and then click Refresh .

ShadowImage Error Window

The SI390 Java applet program displays error messages on the Command View management station when error conditions occur during SI390 operations. The ShadowImage Error window displays the SI390 error code and message. To display the Error window, select the failed volume in the Preset Volume List box on the ShadowImage main window, right-click to display the pop-up menu, and then click **Detail**.

Using Compatible Mirroring for IBM FlashCopy Version2

To enable Compatible Mirroring for IBM FlashCopy Version2 (shortened to FlashCopy Mirror Version 2 where applicable hereafter) to function on the local disk array, the ShadowImage for z/O feature and software and the FlashCopy Mirror Version 2 feature and software must be installed and enabled on the local disk array.

In some cases, there may be a need to install additional shared memory before installing FlashCopy Mirror Version 2. For details, please contact your HP account representative.

PPRC TSO commands and/or DFSMSdss commands issued from the host may be used to perform FlashCopy Mirror Version 2 operations on the local disk array. See "[Using Compatible Mirroring for IBM FlashCopy Version 2 Host Commands](#)" on page 328 for further information on using PPRC TSO commands and DFSMSdss commands.



WARNING! FlashCopy Mirror and FlashCopy Mirror Version 2 cannot be used simultaneously. If one or more FlashCopy Mirror pairs still exist in the disk array, you cannot establish any FlashCopy Mirror Version 2 pairs until you withdraw all the existing FlashCopy Mirror pairs.

Overview of Compatible Mirroring for IBM FlashCopy Version 2

The FlashCopy Mirror Version 2 function provides a fast data replication capability. This function allows you to copy the source data to a targeted volume virtually or physically. Creating the pair by FlashCopy Mirror Version 2 is called “establishing relationship”. Once a FlashCopy Mirror Version 2 pair is created, hosts can access data that is copied to the targeted volume.

When you want to copy the data according to dataset, you specify the copy range, then the FlashCopy Mirror Version 2 creates a pair of only the specified dataset. The copy range is called the “extent”. The smallest unit used to measure the extent is called the “track”. When the copy source extent and the copy target extent are in the different volumes, the volume that contains the copy source extent is called an S-VOL, and the volume that contains the copy target extent is called a T-VOL.

FlashCopy Mirror Version 2 allows you to create up to 16 pairs from one extent. The copy source extent and copy target extents may co-exist in the same volume. The figure below illustrates the examples of FlashCopy Mirror Version 2 pairs.

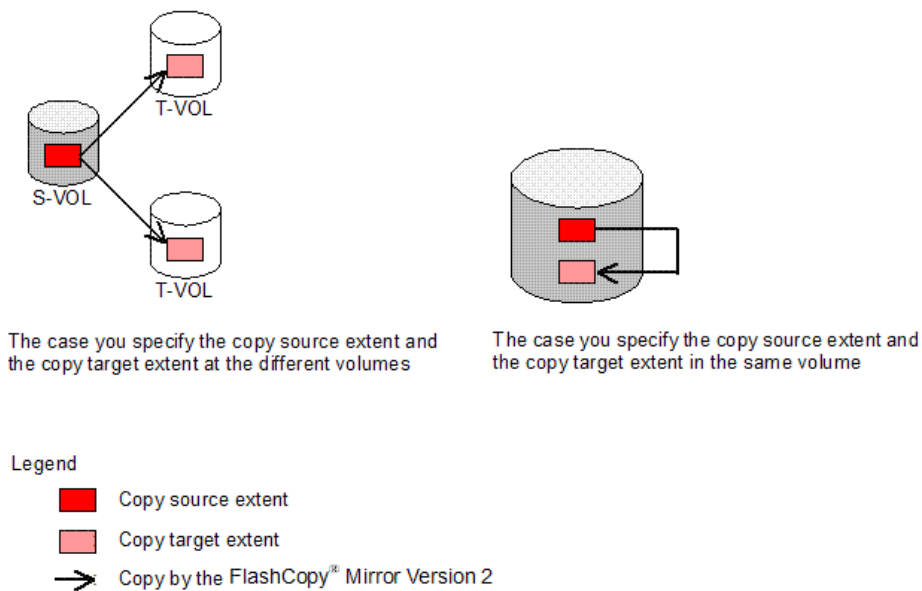


Figure 118 Examples of FlashCopy Mirror Version 2 Pairs Created Between Extents

The extent that is already set as the copy target cannot be used as a copy source extent to create a new FlashCopy Mirror Version 2 pair. In other words, you cannot create a cascaded FlashCopy Mirror Version 2 pairs. See [Figure 119](#) for the example.

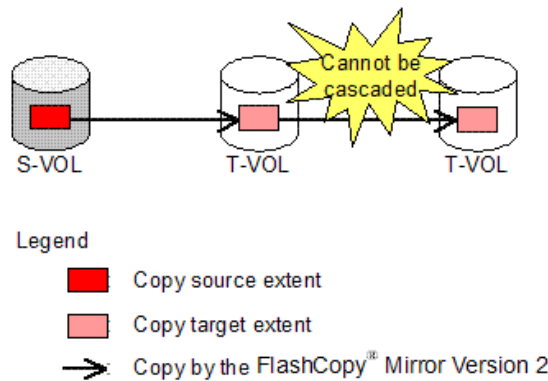


Figure 119 Example of the Case FlashCopy Mirror Version 2 Pair Cannot be Created

[Table 101](#) shows the requirements for using FlashCopy Mirror Version 2.

Table 101 Requirements for FlashCopy Mirror Version 2

Item	Requirement
Controller emulation type	I-2105

The emulation types for mainframe that are supported by FlashCopy Mirror Version 2 are as follows.

- 3390-1
- 3390-2
- 3390-3
- 3390-3R
- 3390-9
- 3390-L

These emulation types can be applied to the S-VOLs or T-VOLs. Note that the specified extent must be within the range of the user cylinders in each volume.

Functionalities of Compatible Mirroring for IBM FlashCopy Version2

FlashCopy Mirror Version 2 supports the functionalities below.

- Establishing multiple relationship (See ["Establishing Multiple Relationships"](#) on page 316)
- Specifying COPY mode or NOCOPY mode (See ["Specifying COPY mode or NOCOPY mode"](#) on page 316)
- Volume copying (See ["Volume Copying and Dataset Copying"](#) on page 317)
- Dataset copying (See ["Volume Copying and Dataset Copying"](#) on page 317)

Establishing Multiple Relationships

Creating the multiple pairs from one extent is called “multiple relationship”. FlashCopy Mirror Version 2 allows you to create up to 16 pairs from one extent. The figure below illustrates the examples of multiple relationships.

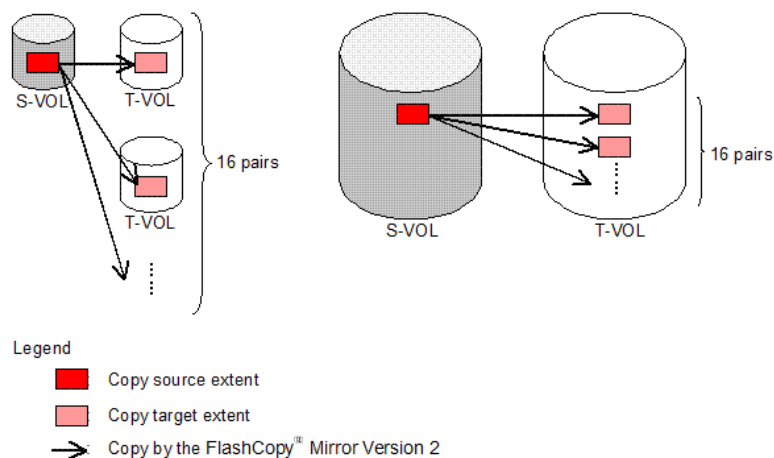


Figure 120 Examples of Multiple Relationships

Specifying COPY mode or NOCOPY mode

Before starting the copy operation, FlashCopy Mirror Version 2 allows you to select the mode to run the copy operation between COPY mode and NOCOPY mode. When you do not select the mode, FlashCopy Mirror Version 2 automatically selects COPY mode.

When you select COPY mode, FlashCopy Mirror Version 2 copies all the data in the S-VOL to the T-VOL. This process is called “background copying”. FlashCopy Mirror Version 2 automatically withdraw the pair when the background copying is complete. Note that when you select NOCOPY mode, FlashCopy Mirror Version 2 omits the background copying process.

If there is a request for write operation to the space in the S-VOL from where the data is not yet copied or a request for read/write operation to the space in the T-VOL to where the data is not yet copied,

FlashCopy Mirror Version 2 first copies the old data in the S-VOL to the T-VOL. This process is called “on-demand copying”. The figure below illustrates the process of the on-demand copying.

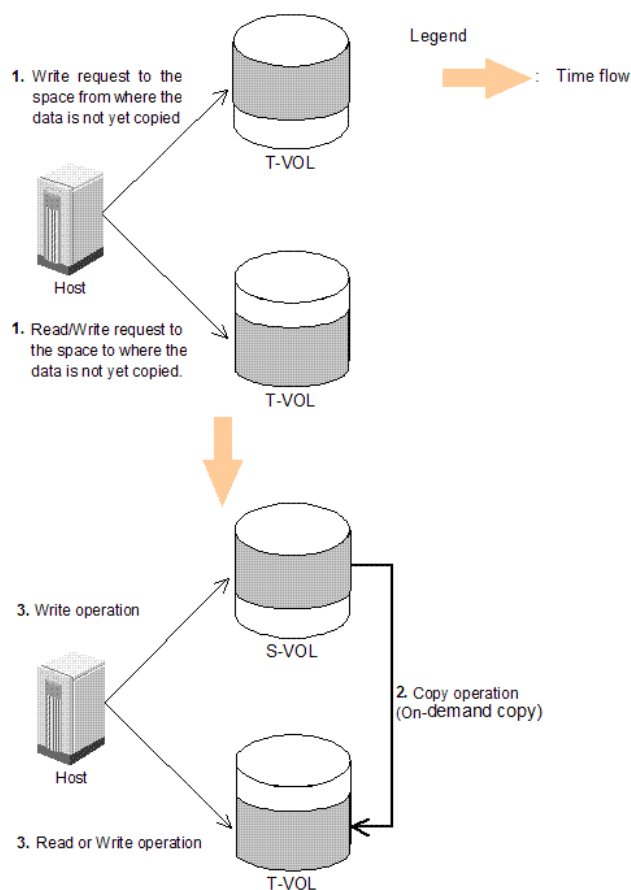


Figure 121 On-demand Copying

1. From the host, there is a write request to the space in the S-VOL from where the data is not yet copied, or there is a Read or Write request to the space in the T-VOL to where the data is not yet copied.
2. When there is a request shown above is made to the space in the S-VOL or T-VOL from or to where the data is not yet copied, FlashCopy Mirror Version 2 performs on-demand copying before the Read or Write operation. By on-demand copying, the data is copied from the S-VOL to the T-VOL.
3. When on-demand copying is completed, the Read or Write operation is performed.



WARNING! When the NOCOPY mode is selected, even if all the data in the S-VOL is copied to the T-VOL by the on-demand copying process, the FlashCopy Mirror Version 2 does not automatically withdraw the pair. So, when you selected NOCOPY mode, you must withdraw the pair by using FCWITHDR command. For details about FCWITHDR command, see “[Withdrawing FlashCopy Mirror Version 2 Pairs: FCWITHDR](#)” on page 335.

Volume Copying and Dataset Copying

FlashCopy Mirror Version 2 allows you to select the two types of copying. One type is the volume copying, which copies the whole volume. Another type is the dataset copying, which copies only the specified copy range (extent). While the volume copying establishes the relationship with the entire volume, the dataset copying establishes the relationship only to the specified extent or extents. You can specify the multiple extents.

To perform volume copying, the capacity of the copy source extent must be equal to or larger than the capacity of the copy target extent. To perform dataset copying, the number of tracks of the copy source

extent and the copy target extent must be the same. Dataset copying allows you to establish up to 16 relationships to the copy source extent.

- FlashCopy Mirror Version 2 can perform dataset copying when:
 - The position of the copy source extent is different from the position of the copy target extent.
 - The volume of the copy source extent is different from the volume of the copy target extent.
 - The copy source extent and the copy target extent are in the same volume, provided that they do not overlap.
 - The data in a single source extent is to be copied simultaneously to multiple target extents.
 - Volume copying is also performed simultaneously in the same sourced volume.
 - Two source extents overlap, or one of them is an inclusive part of the other (see [Figure 122](#)), provided that the number of overlapping extents in each overlapped area is not more than 16 extents.

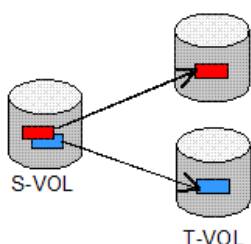


Figure 122 Overlap of Copy Source Extents

- FlashCopy Mirror Version 2 cannot perform dataset copying when:
 - Any one of the copy target extents is overlapping a copy source or target extent.
 - A copy target extent that already has a relationship established is used to establish a new relationship with a copy source or target extent that overlaps.

[Table 102](#) shows the compatibility between the FlashCopy Mirror Version 2 functions and the user interface functions.

Table 102 Compatibility between FlashCopy Mirror Version 2 and User Interface Functions

User Interface	Function	Functions			
		Volume copying	Dataset copying	COPY mode	NO COPY mode
DFSMSdss TSO	Multiple relations	Supported	Supported	Supported	Supported
	COPY mode	Supported	Supported	Supported ¹	N/A
	NOCOPY mode	Supported	Supported	N/A	N/A

1. Represents the case when the copy operation mode is changed from NOCOPY mode to COPY mode.

Maximum Number of FlashCopy Mirror Version 2 Pairs

FlashCopy Mirror Version 2 can establish up to 32,768 pairs. However, FlashCopy Mirror Version 2 may not be able to establish up to 32,768 relations depending on the number of resources required for the copy operation that vary according to the attributes (emulation type, capacity, the size of the data that is copied, the position of the extent) of the volumes and extents used for establishing the pairs. Furthermore, the total number of available resources also varies according to the number of CUs. You

can use the **FlashCopy Information** pane (see [Figure 100](#)) to check the number of remaining resources that are currently available. Check the **FlashCopy Information** pane when you create a FlashCopy Mirror Version 2 pair.



NOTE: The following software programs share the resources used for copy operation.

- ShadowImage for z/OS
- Business Copy XP
- Volume Migration
- Cross-system Copy

The resources used by ShadowImage for z/OS, Business Copy XP, Volume Migration, and Cross-system Copy cannot be used for FlashCopy Mirror Version 2. The resources that remain when you exclude the resources used by ShadowImage for z/OS, Business Copy XP, Volume Migration, and Cross-system Copy from the total resources are available resources for FlashCopy Mirror Version 2. For details about the calculation of the resources used by each software program, refer to the following manuals.

- *HP StorageWorks Command View XP for XP Disk Arrays User Guide*
- *Volume Migration User's Guide*
- *Cross-system Copy User's Guide*

For details about ShadowImage for Mainframe, see ["Requirements on the Maximum Number of Pairs" on page 234](#).

- Creating pairs by volume copying

For the information about the number of pairs that can be created, see [Table 103](#).

When volumes that differ in the emulation type and capacity are, the number of relations that can be established is determined according to the following condition.

The maximum number of relations that can be established is the largest number that meets the equation, $\Sigma(\alpha) = (\beta)$, where:

$\Sigma(\alpha)$ stands for the total number of resources used per a pair (see [Table 103](#)), and

(β) stands for the total number of resources available in the local disk array.

$(\beta) = 13,652$ when additional shared memory is not installed.

$(\beta) = 30,718$ when additional shared memory is installed.

Table 103 Number of Relations That Can Be Established With Volumes of Each Emulation Type and Capacity

Emulation Type	RAID Level			Number of resources used per pair (α)		
	RAID1 (2D+2D)	RAID5 (3D+1P)	RAID5 (7D+1P)	S-VOL	T-VOL	Total
3390-3	Does not depend on the capacity			1	1	2
3390-3R	Does not depend on the capacity			1	1	2
3390-2	Does not depend on the capacity			1	1	2

Table 103 Number of Relations That Can Be Established With Volumes of Each Emulation Type and Capacity (continued)

Emulation Type	RAID Level			Number of resources used per pair (α)		
	RAID1 (2D+2D)	RAID5 (3D+1P)	RAID5 (7D+1P)	S-VOL	T-VOL	Total
3390-1	Does not depend on the capacity			1	1	2
3390-9	1 - 4,063 CYL	1 - 4,061 CYL	1 - 4,059 CYL	1	1	2
	4,064 - 8,150 CYL	4,062 - 8,149 CYL	4,060 - 8,147 CYL	2	2	4
	8,151 - 10,017 CYL	8,150 - 10,017 CYL	8,148 - 10,017 CYL	3	3	6
3390-L	1 - 4,064 CYL	1 - 4,063 CYL	1 - 4,061 CYL	1	1	2
	4,065 - 8,151 CYL		4,062 - 8,149 CYL	2	2	4
	8,152 - 12,239 CYL		8,150 - 12,237 CYL	3	3	6
	12,240 - 16,326 CYL	12,240 - 16,325 CYL	12,238 - 16,325 CYL	4	4	8
	16,327 - 20,414 CYL	16,326 - 20,413 CYL		5	5	10
	20,415 - 24,501 CYL	20,414 - 24,501 CYL		6	6	12
	24,502 - 28,589 CYL	24,502 - 28,588 CYL	24,502 - 28,589 CYL	7	7	14
	24,590 - 32,676 CYL	24,589 - 32,676 CYL	24,590 - 32,673 CYL	8	8	16
	32,677 - 32,760 CYL	32,677 - 32,760 CYL	32,674 - 32,760 CYL	9	9	18

The figures in [Table 103](#) represent the case when FlashCopy Mirror Version 2 alone uses all the resources. CYL means the number of cylinder.

- Creating pairs by dataset copying

To create pairs between extents, the same number of resources listed under the column “Number of resources used per pair” (see [Table 103](#)) is necessary, provided that no extents in the same volume overlap. If the extents used for establishing the pairs overlap, the number of resources required to establish the relations is the number of resources listed under the column “Number of resources used per pair” multiplied by the number of extents that overlap.

The following figures illustrate the different cases of copying, for example when the extents overlap or not. For information about the calculation example of the used resources, see [Table 104](#).

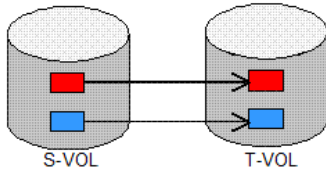


Figure 123 Copying Data in Two Extents that do not Overlap (One T-VOL)

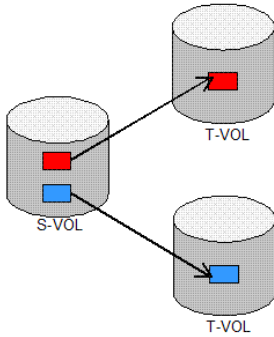


Figure 124 Copying Data in Two Extents that do not Overlap (Two T-VOLs)

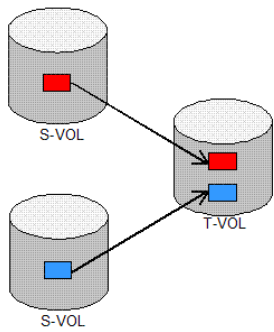


Figure 125 Copying Data in Two Extents that do not Overlap (Two S-VOLs)

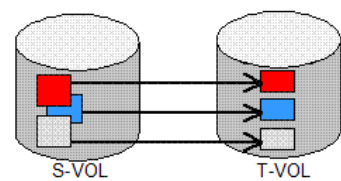


Figure 126 Copying Data in Three Extents that Overlap (One T-VOL)

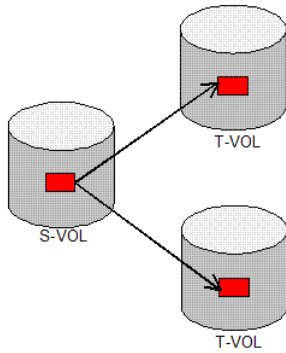


Figure 127 Copying Data in Two Extents that Overlap (Two T-VOLs)

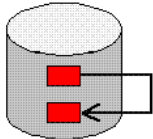


Figure 128 Copying One Extent to Another in the Same Volume

Table 104 provides the calculation examples of the required resources according to the patterns of copying.

Table 104 Referential Examples for Calculating the Number of Resources Required to Create the FlashCopy Mirror Version 2 Pairs

Copy Patterns	Required number of resources					
	3390-3, 3390-3R, 3390-2, 3390-1, 3390-9			3390-L (30,178 CYL or more)		
	S-VOL	T-VOL	Total	S-VOL	T-VOL	Total
Copying Data in Two Extents that do not Overlap (One T-VOL) See Figure 123	3	3	6	9	9	18
Copying Data in Two Extents that do not Overlap (Two T-VOLs) See Figure 124	3	6 (3 + 3)	9	9	18 (9 + 9)	27
Copying Data in Two Extents that do not Overlap (Two S-VOLs) See Figure 125	6 (3 + 3)	3	9	18 (9 + 9)	9	27
Copying Data in Three Extents that Overlap (One T-VOL) See Figure 126	9 (3 x 3)	3	12	27 (9 x 3)	9	36

Table 104 Referential Examples for Calculating the Number of Resources Required to Create the FlashCopy Mirror Version 2 Pairs (continued)

Copy Patterns	Required number of resources					
	3390-3, 3390-3R, 3390-2, 3390-1, 3390-9			3390-L (30,178 CYL or more)		
	S-VOL	T-VOL	Total	S-VOL	T-VOL	Total
Copying Data in Two Extents that Overlap (Two T-VOLs) See Figure 127	6 (2 x 3)	6 (3 + 3)	12	18 (9 x 2)	18 (9 + 9)	36
Copying One Extent to Another in the Same Volume See Figure 128	6 (3 for copy source extent, 3 for copy target extent)	N/A	6	18 (9 for copy source extent, 9 for copy target extent)	N/A	18



NOTE:

- In the case of the emulation type 3390-1, 3390-2, 3390-3, or 3390-3R, maximum number of resources that can be used as S-VOL is 16. You cannot create any pair if 16 resources are already used in the S-VOL, and if the copy data range of relationships that are already established overlap with all the resources.
- In the case of the emulation type 3390-9, maximum number of resources that can be used as S-VOL is 48.
- In the case of the emulation type 3390-L, maximum number of resources that can be used as S-VOL is 144.

The number of pairs that can be created is determined according to the following condition.

The maximum number of relations that can be established is the largest number that meets the equations, $\Sigma(\alpha) = (\beta)$ and $\Sigma(\gamma) = 32,768$, where:

$\Sigma(\alpha)$ stands for the total number of resources that need to be used,

(β) stands for the total number of resources available in the local disk array,

$(\beta) = 13,652$ when additional shared memory is not installed.

$(\beta) = 30,718$ when additional shared memory is installed.

And $\Sigma(\gamma)$ stands for the total number of pairs.

The following figure shows the example of when 7 pairs are created with 3390-3 volumes, and 3 pairs are created with 3390-L volumes (32,769 CYL).

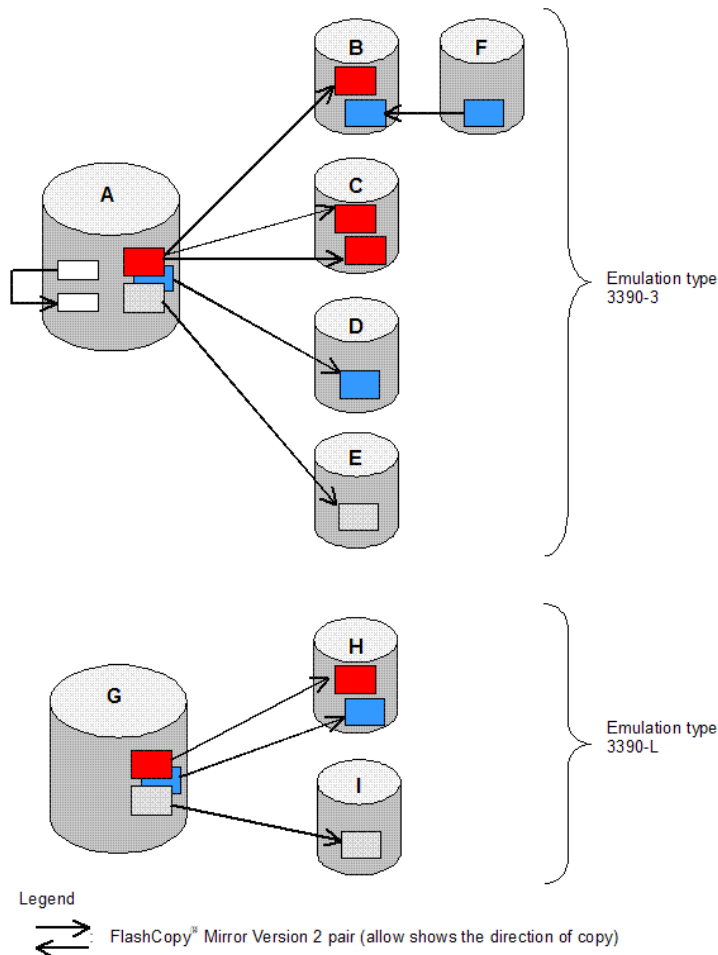


Figure 129 Referential Example for Calculating the Number of Pairs

According to [Figure 129](#), the total number of resources used per pair is calculated as:

$$\text{Resources used for A - H} = (3 + 1) + 1 + 1 + 1 + 1 + 1 + (9 \times 3) + 9 + 9 = 54.$$

The conditions for the number of pairs you can create are:

$$\Sigma(\alpha) \leq \beta \text{ and } \Sigma(\gamma) \leq 32,768$$

In the case of the example shown in [Figure 129](#), $54 \leq 13,652$ when additional shared memory is not installed, $54 \leq 30,718$ when additional shared memory is installed. Since the example shown in [Figure 129](#) meets the conditions shown above, you can create all the pairs in [Figure 129](#).

Installing and Uninstalling Compatible Mirroring for IBM FlashCopy Version2

This sections describes how to install and uninstall FlashCopy Mirror Version 2.

Installing Compatible Mirroring for IBM FlashCopy Version2

This section describes how to install FlashCopy Mirror Version 2. The installing steps are different depending on whether FlashCopy Mirror is installed or not. Note that you do not need to see [step 2](#) and [step 3](#) if you do not have installed FlashCopy Mirror.

To install FlashCopy Mirror Version 2:

1. Check whether there is a need to install additional shared memory or not.
For details, please contact your HP account representative.
2. Withdraw all the relationships to delete FlashCopy Mirror pairs.
Use Command View XP or host command to select and delete all the settings that use FlashCopy Mirror.
3. Check that all the FlashCopy Mirror pairs are deleted.
You can use Command View XP or FCQUERY command to check if all the FlashCopy Mirror pairs are deleted. For details about FCQUERY command, see "[Displaying Information on FlashCopy Mirror Version 2 Pairs: FCQUERY](#)" on page 345.
4. Install the FlashCopy Mirror Version 2 feature and software.
5. Set the corresponding devices offline from your host, and then set these devices back again to online.
6. Execute the devserv command with the VALIDATE option of QDASD to the devices in the subsystem.
The figure below shows the example of the devserv command.

```
devserv QDASD, 4200, VALIDATE
```

Figure 130 Example of devserv Command

By executing the command, you will be able to view the information of the direct access memory device 4200 and the magnetic disk controller. Base on the displayed information, update the information on the expanded functions maintained in the storage of the host processor. By these operations, the host recognize that FlashCopy Mirror Version 2 is supported.

7. Create FlashCopy Mirror Version 2 pairs.
8. Check that all the FlashCopy Mirror Version 2 pair you wanted to create are created.
You can use Command View XP or FCQUERY command to check if all the FlashCopy Mirror Version 2 pairs are created. For details about FCQUERY command, see "[Displaying Information on FlashCopy Mirror Version 2 Pairs: FCQUERY](#)" on page 345.



NOTE:

- You need to perform offline/online operation once to one device used for FlashCopy Mirror Version 2 in each CU.
- If there remains any FlashCopy Mirror pair, you cannot uninstall FlashCopy Mirror feature and software. In this case, even if you install FlashCopy Mirror Version 2, its feature will not be available, and the feature of FlashCopy Mirror will be performed. To use the feature of FlashCopy Mirror Version 2, make sure that you delete all the FlashCopy Mirror pairs.
- Even when the license of FlashCopy Mirror is expired, you can still delete the FlashCopy Mirror pairs. Even if the license is expired, if there remains any FlashCopy Mirror pair, FlashCopy Mirror will be performed instead of FlashCopy Mirror Version 2. To use the feature of FlashCopy Mirror Version 2, make sure that you delete all the FlashCopy Mirror pairs.

Uninstalling Compatible Mirroring for IBM FlashCopy Version2

This section describes how to uninstall FlashCopy Mirror Version 2.

To uninstall FlashCopy Mirror Version 2:

1. Withdraw all the FlashCopy Mirror Version 2 pairs by using a host command.

2. Check that all the FlashCopy Mirror Version 2 pairs are deleted.

You can use Command View XP or FCQUERY command to check if all the FlashCopy Mirror Version 2 pairs are deleted. For details about FCQUERY command, see ["Displaying Information on FlashCopy Mirror Version 2 Pairs: FCQUERY"](#) on page 345.

3. Uninstall the FlashCopy Mirror Version 2 feature and software.
4. If you do not need ShadowImage for z/OS, uninstall the ShadowImage for z/OS feature and software.
5. Set the corresponding devices offline from your host, and then set these devices back again to online.
6. Execute the devserv command with the VALIDATE option of QDASD to the devices in the subsystem.
For the example of the devserv command, see [Figure 130](#).
7. Perform the mainframe host path offline/online operation from your host.



NOTE:

- You need to perform offline/online operation once to one device used for FlashCopy Mirror Version 2 in each CU.
- FlashCopy Mirror Version 2 does not support the REMOVEFCPY parameter of ICKDSF CONTROL command. To withdraw all the FlashCopy Mirror Version 2 pairs in the subsystem, you need to use the ShadowImage for z/OS main panel.

Establishing Compatible Mirroring for IBM FlashCopy Version 2 Pairs

Combining Compatible Mirroring for IBM FlashCopy Version 2 With Other Copy Solutions

The local disk array provides copy solutions other than FlashCopy Mirror Version 2. ShadowImage for z/OS (SIz), TrueCopy for z/OS (TCz), Extended Remote Copy/Concurrent Copy, and Volume Migration. However, only ShadowImage for z/OS can be used with FlashCopy Mirror Version 2. The figure below shows the example of combining FlashCopy Mirror Version 2 with ShadowImage for z/OS.

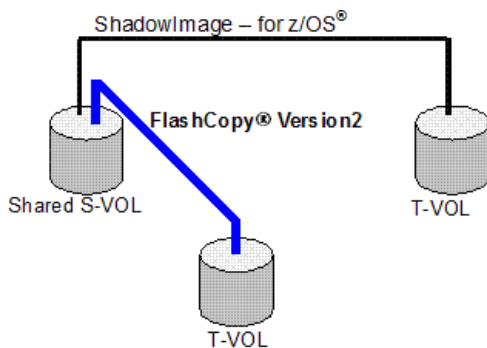


Figure 131 Pair Configuration Where an S-VOL of FlashCopy Mirror Version 2 and SIz is Shared

The table below shows the operations that can be performed on the FlashCopy Mirror Version 2 pairs.

Table 105 Relationship Between FlashCopy Mirror Version 2 Pair and Operation of the Copy Solutions

Copy Solution	Operation	FlashCopy Mirror Version 2 Pair	
		Pair exists	Pair does not exist
FlashCopy Mirror Version 2	Establish relationship	OK	OK (See Note below)
	Withdraw relationship	OK	OK (See Note below)
Slz	Add Pair	OK	OK
	Split Pair	OK	OK
	Suspend Pair	OK	OK
	Resync Pair	OK	OK
	Reverse Resync	OK	N/A
	Quick Restore	OK	N/A
	Delete pair	OK	OK



NOTE: OK only when the conditions described in “[Volume Copying and Dataset Copying](#)” on page 317 are satisfied.

Table 106 Relationship Between Slz Pair Status and FlashCopy Mirror Version 2 Operations

SI-FCv2 operation	Slz Pair Status								
	Simplex	Pending	Duplex	SP-Pend	V-Split	Split	Resync	Resync-R	Suspend
Establish relation	OK	OK	OK	OK	OK	OK	OK	NG	OK
Withdraw relation	OK	OK	OK	OK	OK	OK	OK	NG	OK

Even if the Slz S-VOL already has three T-VOLs, you can create up to 16 pairs by specifying the volumes of FlashCopy Mirror Version 2 pairs as the copy source.

In the cases shown below, you cannot create Slz pairs (see also [Figure 132](#)).

- The case the S-VOL of the FlashCopy Mirror Version 2 pair and the T-VOL of the Slz pair is shared.
- The case the T-VOL of the FlashCopy Mirror Version 2 pair and the T-VOL of the Slz pair is shared.

- The case the T-VOL of the FlashCopy Mirror Version 2 pair and the T-VOL of the Siz pair is shared.

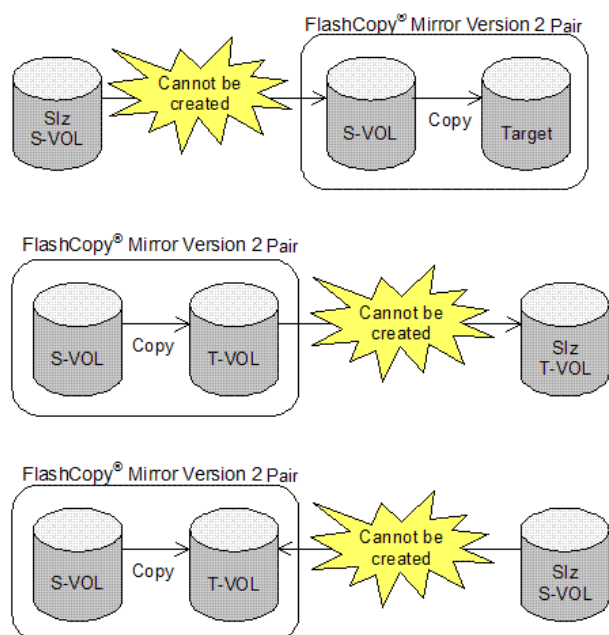


Figure 132 Cases When FlashCopy Mirror Version 2 and Siz Cannot be Used in Conjunction

When you use FlashCopy Mirror Version 2, you cannot create pairs sharing the volumes shown in [Figure 132](#). However, if you use ShadowImage for z/OS, you can create the pair which shares FlashCopy Mirror Version 2 S-VOL and Siz T-VOL, or the pair which shares FlashCopy Mirror Version 2 T-VOL and Siz S-VOL.

Combining Compatible Mirroring for IBM FlashCopy Version 2 With Other Solutions

The following table shows whether you can or cannot set attributes to the volumes in the case the volumes that are specified as S-VOL or T-VOL of a FlashCopy Mirror Version 2 pair have the attributes of Volume Retention Manager or Volume Security.

Table 107 Compatibility of Volumes Shared by FlashCopy Mirror Version 2 and Security Solutions

Solutions	Attribute	FlashCopy Mirror Version 2	
		S-VOL	T-VOL
Volume Retention Manager	Protect	This attribute cannot be set.	This attribute cannot be set.
	Read only	This attribute can be set.	This attribute can be set.
	Read/Write	This attribute can be set.	This attribute can be set.
Volume Security	Security setting that disable the use as S-VOL	This setting can be made.	This setting cannot be made.

Using Compatible Mirroring for IBM FlashCopy Version 2 Host Commands

FlashCopy Mirror Version 2 supports both DFSMSdss commands and TSO PPRC commands to enable you to perform FlashCopy Mirror Version 2 operations from the zSeries and S/390 host system. The operation system versions that support FlashCopy Mirror Version 2 are OS/390 V2R10 and z/OS V1R0 and higher. An appropriate PTF is necessary for each.

This user guide does not provide complete instructions for using commands from the host system. For detailed information on using DFSMSdss and TSO PPRC commands, please refer to the following IBM user documents.

- *z/OS DFSMSdss Storage Administration Reference* (SC35 0424)
- *z/OS DFSMS Advanced Copy Services* (SC35 0428)
- *z/OS DFSMSdss Advanced Services* (SC26-7400)

DFSM Command Supported by Compatible Mirroring for IBM FlashCopy Version 2

This section only describes how to use the representative DFSMSdss commands related to FlashCopy Mirror Version 2. For detailed information on using DFSMSdss commands, please refer to the following IBM user document: *z/OS DFSMSdss Storage Administration Reference* (SC35 0424).



NOTE: FlashCopy Mirror Version 2 supports VSAM datasets. However, when the user specifies attributes for the copy source extents that differ from those specified for the copy target extents, DFSMSdss invokes a different program (such as IDCAMS), and, as a result, FlashCopy Mirror Version 2 may not be able to use VSAM datasets. For further information, please refer to the IBM user document mentioned above.

Creating FlashCopy Mirror Version 2 Pairs by Volume Copying

The DFSMSdss command used to process FlashCopy Mirror Version 2 volume copy operation is COPYFULL. When the COPYFULL command is issued, DFSMSdss checks whether the selected volumes meet the requirements for use as FlashCopy Mirror Version 2 volumes or not, and automatically determines whether to process the requested job via the host or not. DFSMSdss processes the COPYFULL command in a few seconds and establishes the FlashCopy Mirror Version 2 relationship simultaneously as it completes the processing. The completion of this process is not reported to the user.

Figure 133 shows an example of the DFSMSdss command for processing FlashCopy Mirror Version 2 volume copy operation. In this example, the entire data in a volume numbered FCPY05 is copied to a volume numbered FCPY06.

```
//COPYFULL JOB
// *
//INSTIMG EXEC PGM=ADRDSSU
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=V,OUTLIM=3000
//VOL1 DD UNIT=3390,VOL=SER=FCPY05,DISP=OLD
//VOL2 DD UNIT=3390,VOL=SER=FCPY06,DISP=OLD
//SYSIN DD *
COPY FULL INDYNAM (FCPY05) OUTDYNAM (FCPY06) COPYVOLID
/*
```

Figure 133 Example of DFSMSdss Command (COPYFULL)

When DFSMSdss command “COPYFULL” is executed, all the datasets on the S-VOL are copied to the T-VOL (see Figure 134). Volume area that is not allocated as a dataset is not copied.

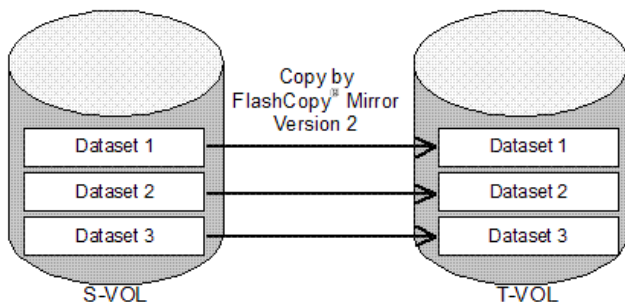


Figure 134 Copying All Datasets Using DFSMSdss Command “COPYFULL”

Creating FlashCopy Mirror Version 2 Pairs by Dataset Copying

The DFSMSdss command used to process FlashCopy Mirror Version 2 dataset copy operation is COPY DS. When the COPY DS command is issued, DFSMSdss checks whether the selected volumes meet the requirements for use as FlashCopy Mirror Version 2 volumes or not, and automatically determines whether to process the requested job via the host or not. DFSMSdss processes the COPY DS command in a few seconds and establishes the FlashCopy Mirror Version 2 relationship simultaneously as it completes the processing. The completion of this process is not reported to the user.

Figure 135 shows an example of the DFSMSdss command for processing FlashCopy Mirror Version 2 dataset copy operation. In this example, the dataset on the volume numbered FCPY05 is copied to a volume numbered FCPY06.

```
//DSSCOPY JOB
// *
//INSTIMG EXEC PGM=ADRDSSU
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=V,OUTLIM=3000
//VOL1 DD UNIT=3390,VOL=SER=FCPY05,DISP=OLD
//VOL2 DD UNIT=3390,VOL=SER=FCPY06,DISP=OLD
//SYSIN DD *
COPY DS(INCL(SAM020.**)) INDDNAME(FCPY05) OUTDDNAME(FCPY06)
FASTREPLICATION(REQUIRED) -
FCNOCOPY DEBUG (FRMSG(DETAILED))
/*
```

Figure 135 Example of DFSMSdss Command (COPY DS)

FlashCopy Mirror Version 2 allows you to establish up to 16 pairs simultaneously from a single copy source extent.

DFSMSdss Copy Command Options

- COPYVOLID

COPYVOLID command option allows you to select whether you want to copy the ID label (VOLSER: Volume Serial Number). When you specify COPYVOLID, the ID label of the volume set as the source is copied to the volume set as the target. When COPYVOLID command is executed, the volume used as the target is set to offline automatically.

The COPYVOLID command had to be specified for volumes controlled by SMS. However, when DUMPCONDITIONING command added by APAR OW45674 is specified, the VOLSER of the source volume is copied to the backup tape or disk. In this case, there is no need of specifying COPYVOLID to copy the volume label.



NOTE: COPYVOLID and DUMPCONDITIONING cannot be specified at the same time.

- DUMPCONDITIONING

DUMPCONDITIONING is used when you want to specify that the purpose of the copy operation is to create a backup copy and not for using the copied volume for application.

- FCNOCOPY

This command sets the copy operation mode to NOCOPY mode. When this command is specified, the background copying process is omitted from the copy operation.

- FASTERREPLICATION

See [Table 108](#) for the explanation of the available parameters of this command. When FASTERREPLICATION is not specified, the copy operation will be performed in the same way when PREFERRED is specified.

Table 108 FASTERREPLICATION Parameter Values

Parameter values	Description
PREFERRED	Executes FlashCopy Mirror Version 2 copy operation as a priority. When FlashCopy Mirror Version 2 is not used, executes concurrent copy or copy operation via the host.
REQUIRED	Executes FlashCopy Mirror Version 2 copy operation unconditionally. When FlashCopy Mirror Version 2 is not used, outputs error.
NONE	Does not execute FlashCopy Mirror Version 2 copy operation.

- DEBUG

This option is for outputting error information in case an error occurs during the copy operation. Therefore, by specifying this option, you will be able to receive information describing the error and its cause(s) in case FlashCopy Mirror Version 2 copy operation fails. You can also specify the amount of error information you want to receive.

Deleting FlashCopy Mirror Version 2 Pairs

There is no DFSMSdds command to delete FlashCopy Mirror Version 2 pairs.

TSO Command Supported by Compatible Mirroring for IBM FlashCopy Version 2

The table below lists and describes the PPRC TSO commands supported by FlashCopy Mirror Version 2.



NOTE: To use the following PPRC TSO commands, you must add the command names to the AUTHCMD PARM of IKJTSOxx which is a member of SYS1.PARMLIB, because the host system is protected by RACF Facility.

Table 109 PPRC TSO Commands Supported by FlashCopy Mirror Version 2

Operation	Command	Function
Establish relationship	FCESTABL	Establishes SI-FCv2 relation(s) between the source and target volume data.

Table 109 PPRC TSO Commands Supported by FlashCopy Mirror Version 2 (continued)

Operation	Command	Function
Withdraw relationship	FCWITHDR	Withdraws existing SI-FCv2 relation(s).
Confirm FlashCopy Mirror Version 2 pair status	FCQUERY	Allows you to obtain information on volume attributes and number of relations.

The table below lists and describes the parameters of PPRC TSO commands supported by FlashCopy Mirror Version 2.

Table 110 Parameters of PPRC TSO Commands Supported by FlashCopy Mirror Version 2

Command	Parameter	Description
FCESTABL	SDEVN	Source device number. (This parameter is essential.)
	TDEVN	Target device number. (This parameter is essential.)
	MODE	<p>COPY = Default setting. All the data in the copy range of the volume specified as the source by SDEVN is background-copied to the volume specified as the target by TDEVN. The relationship ends automatically and the FlashCopy Mirror Version 2 pair is deleted when all the data is copied.</p> <p>NOCOPY = Data is not copied in the background. The relationship does not end automatically even when all the data is copied. To withdraw the relationship, use the FCWITHDR command. In the following data access occurs, the data subject to read/write processing is copied from the source to the target before FlashCopy Mirror Version 2 read/write processing starts.</p> <ul style="list-style-type: none"> • When there is access to write data on the copy source of the specified area (within the extent), • When there is access to write data on the copy target of the specified area (within the extent), or, • When there is access to read data on the copy target of the specified area (within the extent).
	ONLINTGT	<p>YES = The path group is not checked. The relationship is established even when the copy target is online.</p> <p>NO = Default setting. The path group is checked. The relationship is not established when the copy target is online.</p>
	EXTENTS	Specifies the extent (copy range) by setting the same starting and ending addresses of the source and target with CCHH (cylinder and head numbers). From the copy source, the specified data is copied to the same offset position on the copy target. Up to 32 extents can be specified. When EXTENTS is not specified, the data on all the tracks are copied.
	XTNTLST	Specifies the extent (copy range) by setting the starting and ending addresses of the source and the starting and ending addresses of the target with CCHH (cylinder and head numbers). From the copy source, the specified data is copied to a different offset position on the copy target. Up to 32 extents can be specified. When XTNTLST is not specified, the data on all the tracks are copied.

Table 110 Parameters of PPRC TSO Commands Supported by FlashCopy Mirror Version 2 (continued)

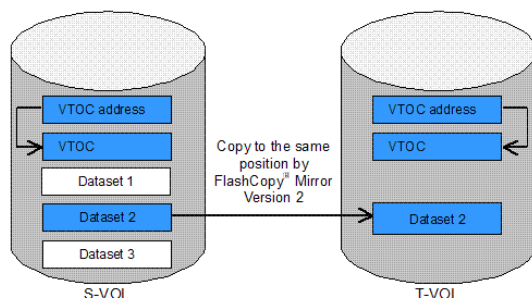
Command	Parameter	Description
FCWITHDR	SDEVN	Source device number.
	TDEVN	Target device number.
	DDSW	YES = The relationships established on the volume specified as the copy source by SDEVN are withdrawn. The relationships are withdrawn after the contents of the volume specified as the copy target by TDEVN are fixed. NO = Default setting. The relationships established on the copy target are all withdrawn. The relationship is not established when the copy target is online. For further information about this parameter, see "Withdrawing FlashCopy Mirror Version 2 Pairs: FCWITHDR" on page 335.
	XTNTLST	Specifies the extent (the range to withdraw the relation) the starting and ending addresses of the source and the starting and ending addresses of the target with CCHH (cylinder and head numbers). Up to 32 extents can be specified. When XTNTLST is not specified, the relationships on all the tracks are withdrawn.
FCQUERY	DEVN	Device number.

**NOTE:**

- The timing to copy the data is different between FlashCopy Mirror Version 2 and IBM FlashCopy. IBM FlashCopy copies data when data in either the source or target volume is updated.
- To execute the XTNTLST parameter, the size of the copy source extent and the copy target extent must be the same.

Creating FlashCopy Mirror Version 2 Pairs: FCESTABL

When the FCESTABL command (TSO command) with EXTENTS parameter specified is executed, only the data on the copy source extent(s) specified by the EXTENTS parameter are copied from the volume specified as the source by SDEVN to the volume specified as the target by TDEVN. For example, when you copy only the "dataset 2", the copy operation processes as shown in [Figure 136](#). When you do not specify the EXTENTS parameter, the entire source volume is copied to the target volume.

**Figure 136** Copying a Dataset by Using TSO (FCESTABL) Command with EXTENTS Parameter Specified

When the FCESTABL command (TSO command) with XTNTLTS parameter specified is executed, only the data on the copy source extent(s) specified by the XTNTLTS parameter are copied to the copy target

extent(s) specified by the XTNTLTS parameter. For example, when you copy only the “dataset 2”, the copy operation processes as shown in [Figure 137](#).

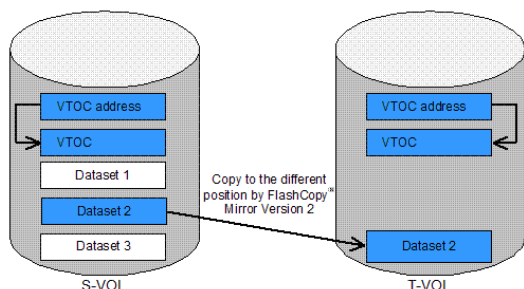


Figure 137 Copying a Dataset by Using TSO (FCESTABL) Command with XTNTLTS Parameter Specified

Procedure for Volume Copying

To perform volume copying by using the TSO command (FCESTABL):

1. Set the T-VOL to offline, or set the ONLINTGT parameter of the FCESTABL command to YES before proceeding to the next step.
2. Without specifying the EXTENTS and XTNTLST parameters, execute the FCESTABL command.
3. Change the VOLSER of the T-VOL.



NOTE: When VTOC is copied, the VOLSER of the S-VOL and the T-VOL will become the same. This step must be performed before setting the volume specified as the T-VOL back to online.

4. If the T-VOL is set to offline in [step 1](#), set the T-VOL back to online.

This step is not necessary if the ONLINTGT parameter of the FCESTABL command is set to YES.

Procedure for Dataset Copying

To perform dataset copying by using the TSO command (FCESTABL):

1. By using the VTOC list stored in the S-VOL, check the VTOC (INDEX, VTOC, etc.) and the position of the extent (CCHH, size) used for the dataset copy operation.
2. Create the copy target dataset on the T-VOL.
3. Acquire the VTOC list stored in the T-VOL.
4. Set the T-VOL to offline, or set the ONLINTGT parameter of the FCESTABL command to YES before proceeding to the next step.
5. Execute the FCESTABL command with the XTNTLST parameter.



NOTE: By using the XTNTLST parameter of the FCESTABL command, you can specify the information on the source and target extents. When there are multiple extents, specify the information on all the extents of the relevant datasets.

FlashCopy Mirror Version 2 allows you to use the XTNTLST parameter in the following ways.

- You may specify multiple copy target datasets to be copied simultaneously from a single copy source dataset.
- You may specify the simultaneous execution of volume copying and dataset copying from a single source volume.

- You may specify multiple source datasets that are overlapping or are an inclusive part of another dataset. However, the number of extents that you may specify per dataset is limited to 16.
 - You cannot specify multiple target datasets that are overlapping.
 - You may specify source and target datasets that differ in position.
 - You may specify the source and target datasets that are in the same volume, provided that they do not overlap.
6. If the T-VOL is set to offline in [step 4](#), set this volume back to online. This step is not necessary if the ONLINTGT parameter of the FCESTABL command is set to YES.



NOTE: FCESTABL command can only be executed once per FlashCopy Mirror Version 2 pair. In other words, you cannot execute this command repeatedly for the same FlashCopy Mirror Version 2 pair.

[Figure 138](#) shows an example of how FCESTABL command is used. In this example, the FCESTABL command specifies that the data on the extent starting from CCHH '01000004' and ending at CCHH '0357000A' in the source device numbered 4202 is to be copied to the extent starting from CCHH '13000001' and ending at CCHH '15570007' in the target device numbered 4203, and the operation mode for copying to the extent starting from CCHH '18A00000' and ending at CCHH '18F30006' is to be set to NOCOPY mode.

```
FCESTABL  SDEVN(X'4202')  TDEVN(X'4203')  MODE(NOCOPY)
          XTNTLST(X'01000004' X'0357000A' X'13000001' X'15570007',
                  X'02AC0006' X'02FF000C' X'18A00000' X'18F30006')
```

Figure 138 Example of FCESTABL Command (NOCOPY)

[Figure 139](#) shows another example of how FCESTABL command is used. In this example, the FCESTABL command specifies that the data in the source device numbered 4202 is to be copied to target device numbered 4203 by COPY mode while 4202 is online.

```
FCESTABL  SDEVN(X'4202')  TDEVN(X'4203')  MODE(COPY) ONLINTGT (YES)
```

Figure 139 Example of FCESTABL Command (COPY)

Withdrawing FlashCopy Mirror Version 2 Pairs: FCWITHDR

FCWITHDR command can be executed to FlashCopy Mirror Version 2 pairs that are already created.

[Table 111](#) describes the parameters of FCWITHDR command and the applicable combinations.

Table 111 Parameters of FCWITHDR Command and Applicable Combinations

Case No.	SDEVN	TDEVN	DDSW	XTNTLST		Process
				Source	Target	
1	Not specified	Specified	NO	Not specified	Not specified	All the relationships established with the copy target extents existing in the device specified by TDEVN are withdrawn. The relationships established with the copy source extents existing in the specified volume are not withdrawn. See Figure 140 .

Table 111 Parameters of FCWITHDR Command and Applicable Combinations (continued)

Case No.	SDEVN	TDEVN	DDSW	XTNTLST		Process
				Source	Target	
2	Not specified	Specified	NO	Specified	Specified	The relationships included in the extents specified by the XTNTLST parameter are withdrawn. The relationships that are only partly included in the specified extents are not withdrawn. See Figure 142 and Figure 144
3	Specified	Specified	NO	Not specified	Not specified	All the relationships established between the source device specified by SDEVN and the target device specified by TDEVN are withdrawn. See Figure 146 .
4	Specified	Specified	NO	Specified	Specified	Among the relationships established between the source device specified by SDEVN and the target device specified by TDEVN, the relationships included in the extents specified by the XTNTLST parameter are withdrawn. The relationships that are only partly included in the specified extents are not withdrawn. See Figure 148 , Figure 150 , and Figure 152 .
5	Specified	Specified or not specified	YES	Not specified	Not specified	<p>All the relationships established with the extents in the source or target device specified by SDEVN are withdrawn.</p> <p>If the device specified by SDEVN is the source and if the relationships are set to the COPY mode, the relationships are withdrawn after the background copy process is completed.</p> <p>If the device specified by SDEVN is the source and if the relationships are set to the NOCOPY mode, the relationships are withdrawn after the copy operation mode is changed to COPY mode and then the background copy process is completed.</p> <p>If the device specified by SDEVN is the target, the relationships are withdrawn immediately.</p> <p>The information on the device specified by TDEVN is ignored. See Figure 153.</p>
6	Specified	Specified or not specified	YES	Specified	Specified	Among the relationships established with the device specified by SDEVN, all the relationships that partly or entirely include the copy target extents specified by the XTNTLST parameter are withdrawn. The information about the specified TDEVN and the copy target extents specified by the XTNTLST parameter are ignored. See Figure 155 .

**NOTE:**

- All combinations other than shown in [Table 111](#) will result in rejection of this command.
- The information specified by the XTNTLST parameter is supported only when the following conditions are fully met:
 - The information specified by the XTNTLST parameter must be for both the source and target. If the information specified by the XTNTLST parameter is only for one of the two, the copy operation will result as an error.
 - The size of the specified copy source and target extents must be the same.

Each of the example cases listed in [Table 111](#) is further explained below with the command description and illustration.

- Case 1: FCWITHDR command (TDEVN: specified, DDSW = NO)

Below is an example of the command description for Case 1. This example requests the withdrawal of all the relationships established with the copy target extents existing in the device numbered 4203.

```
FCWITHDR  TDEVN(X'4203')
```

Figure 140 Example of FCWITHDR Command Description (for Case 1)

By executing the command described above, the relationship established with the specified target, **Dataset 3**, in the device numbered 4203 is withdrawn. Whereas, the relationship established with **Dataset 4** is not withdrawn because it is the dataset specified as the source. In short, there are two relationships before executing the command above, and after executing the command, there is only one relationship.

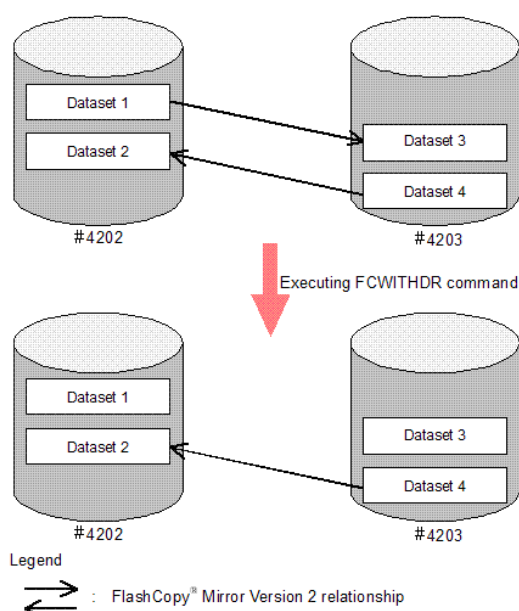


Figure 141 Example of FCWITHDR Command (TDEVN: specified, DDSW = NO)

- Case 2: FCWITHDR command (TDEVN: specified, DDSW = NO, XTNTLST parameter specified)

Below is an example of the command description for Case 2. This example requests the withdrawal of all the relationships established with the copy target extents included in the specified extents within the device numbered 4203.

```
FCWITHDR TDEVN(X'4203') XTNTLST(X'00000000' X' 03000000E' X'20000000' X'
23000000E')
```

Figure 142 Example(1) of FCWITHDR Command Description (for Case 2)

In this case, the specified extents in the device numbered 4203 are contained in **Dataset 3**. Therefore, by executing the command described above, the relationship established with **Dataset 3** is withdrawn. In short, there are two relationships before executing the command above, and after executing the command, there is only one relationship.

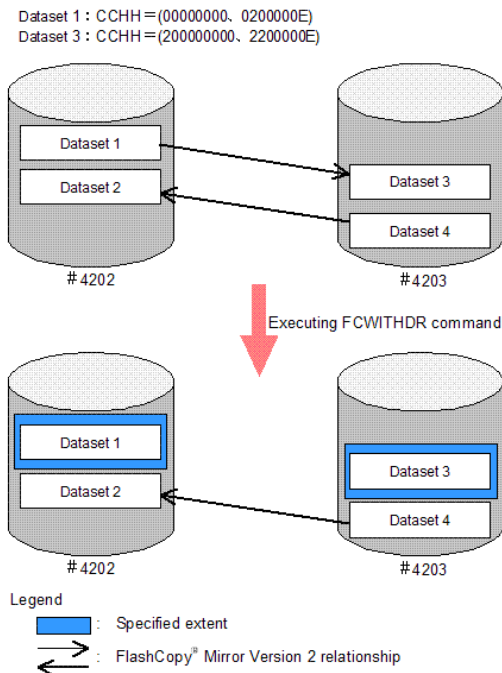


Figure 143 Example(1) of FCWITHDR Command (TDEVN: specified, DDSW = NO, XTNTLST parameter specified)

Below is another example of the command description for Case 2. Similar to the previous example, this example requests the withdrawal of all the relationships established with the copy target extents included in the specified extents within the device numbered 4203.

```
FCWITHDR TDEVN(X'4203') XTNTLST(X'00000000' X' 00000000E' X'20000000' X'
20000000E')
```

Figure 144 Example(2) of FCWITHDR Command Description (for Case 2)

By executing the command described above, the relationship established with the specified target, **Dataset 3**, is not withdrawn because the specified extent within the device numbered 4203 is only a part of **Dataset 3**.

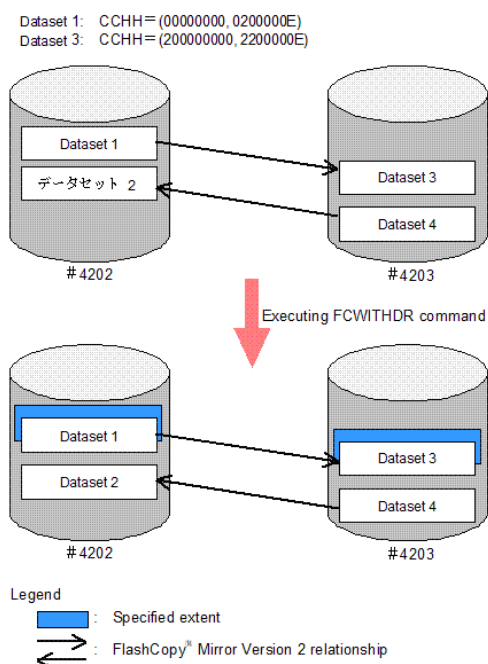


Figure 145 Example(2) of FCWITHDR Command (TDEVN: specified, DDSW = NO, XTNTLST parameter specified)

- Case 3: FCWITHDR command (SDEVN and TDEVN: specified, DDSW = NO)

Below is an example of the command description for Case 3. This example requests the withdrawal of all the relationships established between the device numbered 4202, which in this case is the source, and the device numbered 4203, which in this case is the target.

```
FCWITHDR SDEVN(X'4202') TDEVN(X'4203')
```

Figure 146 Example of FCWITHDR Command Description (for Case 3)

In this case, only the relationships established with **Dataset 3** in the device numbered 4203 are relevant. Therefore, by executing the command described above, the relationship established with **Dataset 3** is withdrawn. **Dataset 6** is specified as the copy target extent, but since the dataset specified as the source, **Dataset 5**, is not in the device numbered 4202, **Dataset 6** is not withdrawn. In

short, there are three relationships before executing the command above, and after executing the command, there are only two relationships.

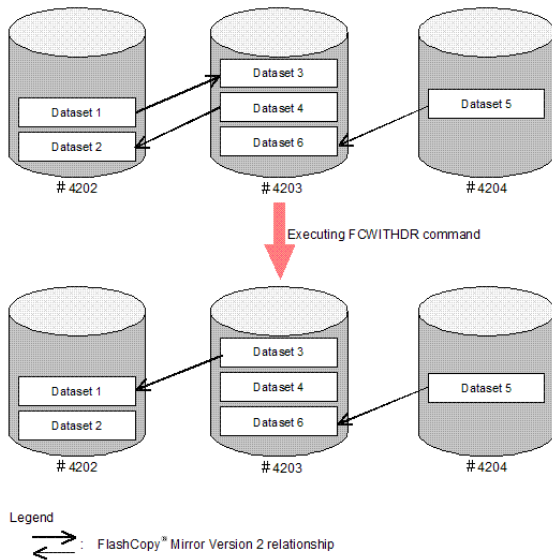


Figure 147 Example of FCWITHDR Command (TDEVN: specified, DDSW = NO)

- Case 4: FCWITHDR command (SDEVN and TDEVN: specified, DDSW = NO, XTNTLST parameter specified)

Below is an example of the command description for Case 4. This example requests the withdrawal of the relationships established within the copy source extent in the device numbered 4202 and the copy target extent in the device numbered 4203.

```
FCWITHDR SDEVN(X'4202') TDEVN(X'4203') XTNTLST(X'00000000' X'0300000E' X'20000000' X'2300000E')
```

Figure 148 Example(1) of FCWITHDR Command Description (for Case 4)

In this case, the specified extent in the device numbered 4202 includes all of **Dataset 1**. Therefore, by executing the command described above, the relationship established with **Dataset 1** is withdrawn. In

short, there are two relationships before executing the command above, and after executing the command, there is only one relationship.

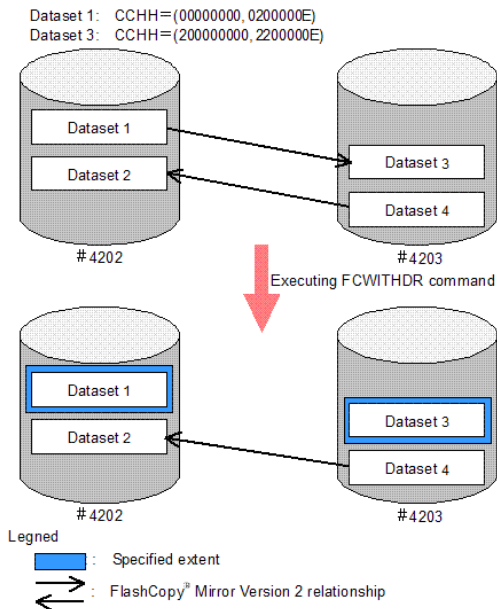


Figure 149 Example(1) of FCWITHDR Command (SDEVN and TDEVN: specified, DDSW = NO, XTNTLST parameter specified)

Below is another example of the command description for Case 4. Similar to the previous example, this example requests the withdrawal of the relationships established within the copy source extent in the device numbered 4202 and the copy target extent in the device numbered 4203.

```
FCWITHDR SDEVN(X'4202') TDEVN(X'4203') XTNTLST(X'00000000' X'0300000E' X'20000000' X'2000000E')
```

Figure 150 Example(2) of FCWITHDR Command Description (for Case 4)

By executing the command described above, the relationship established with **Dataset 1** is not withdrawn because the specified extent in the device numbered 4202 is included as a part of **Dataset 1**.

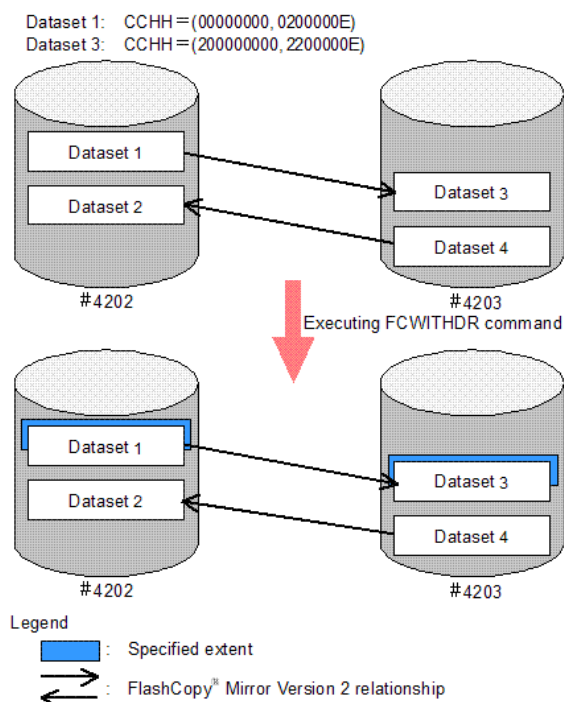


Figure 151 Example(2) of FCWITHDR Command (TDEVN: specified, DDSW = NO, XTNTLST parameter specified)

Moreover, below is an example of the command description that indicates that the extent specified by the XTNTLST parameter is located in the center of **Dataset 1**, and the specified extent in the device numbered 4202 is included as a part of **Dataset 1**. Therefore, the relation established with **Dataset 1** is not withdrawn.

```
FCWITHDR SDEVN(X'4202') TDEVN(X'4203') XTNTLST(X'01000000' X'0100000E'
X'21000000' X'2100000E')
```

Figure 152 Example(3) of FCWITHDR Command Description (for Case 4)



NOTE: Even when the FCWITHDR command set as: SDEVN and TDEVN specified, DDSW = NO, and XTNTLST parameter specified, is executed, this command will do nothing and end normally if either the copy source or target extent specified by the XTNTLST parameter does not cover the extent to which any relationship is established.

- Case 5: FCWITHDR command (SDEVN and TDEVN: specified, DDSW = YES)

Below is an example of the command description for Case 5. When YES is selected for the DDSW parameter, the parameter value for TDEVN is ignored. Therefore, the following two examples show the

same content represented by a different description, both requesting the withdrawal of all the relationships established with the device numbered 4202.

```
FCWITHDR SDEVN(X'4202') DDSW(YES)

FCWITHDR SDEVN(X'4202') TDEVN(X'4203') DDSW(YES)
```

Figure 153 Example of FCWITHDR Command Description (for Case 5)

By executing the command described above, the relations established with **Dataset 1** and **Dataset 2** in the device numbered 4202 are withdrawn. As a result, there will no longer be any relationships established with the device numbered 4202 after executing this command.

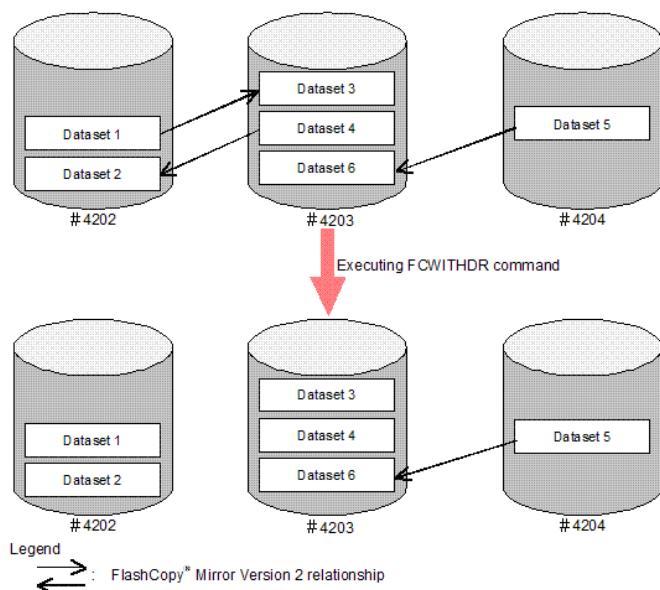


Figure 154 Example of FCWITHDR command (SDEVN and TDEVN: specified, DDSW = YES)

- Case 6: FCWITHDR command (SDEVN and TDEVN: specified, DDSW = YES, XTNTLST parameter specified)

Below are two examples of the command descriptions for Case 6. Both examples request the withdrawal of all those relationships among the relationships established with the device numbered 4202 that are included in the extent specified by the XTNTLST parameter. When DDSW parameter is set to YES, the TDEVN parameter values and the XTNTLST parameter values for the copy target extent are ignored. Therefore, the two command descriptions below both bear the same result.

```
FCWITHDR SDEVN(X'4202') DDSW(YES) XTNTLST(X'01000000' X'1100000E' X'21000000'
X'2200000E')

FCWITHDR SDEVN(X'4202') TDEVN(X'4203') DDSW(YES)
XTNTLST(X'01000000' X'1100000E' X'21000000' X'2200000E')
```

Figure 155 Example of FCWITHDR Command Description (for Case 6)

There are three relationships before executing the command above, and after executing the command, there is only one relationship.

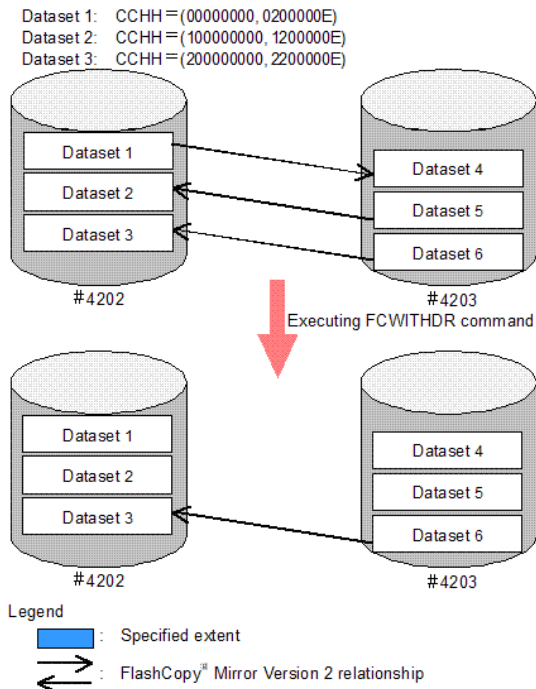


Figure 156 Example of FCWITHDR Command (SDEVN and TDEVN: specified, DDSW = YES, XTNTLST parameter specified)



NOTE: When the FCWITHDR command is executed with DDSW parameter set to YES and XTNTLST parameter specified, only the XTNTLST parameter values specified for the copy source extent are put into effect. When there are no relationships existing within the copy source extent specified by the XTNTLST parameter values, the FCWITHDR command will do nothing and end normally.

The FCWITHDR command can be used to withdraw relationships established for copy operations set either in COPY or NOCOPY mode. When the FCWITHDR command is executed with DDSW parameter set to NO or without setting the DDSW parameter, the relationships specified in the command are withdrawn when the command is executed. When the FCWITHDR command to withdraw relationships established for copy operations set in COPY mode is executed while the background copy operation is in progress, and the relationships specified in the command are withdrawn after the ongoing background copy operation is stopped and cancelled.

When the FCWITHDR command for withdrawing relationships established for copy operations set in COPY mode is executed with DDSW parameter set to YES, the relationships established with the specified copy source extent(s) on the volume specified by SDEVN are withdrawn after the background copy is completed. When the FCWITHDR command for withdrawing relationships established for copy operations set in NOCOPY mode is executed with DDSW parameter set to YES, the relationships established with the specified copy source extent(s) on the volume specified by SDEVN are withdrawn only after the copy operation mode is switched to COPY mode, followed by the execution and completion of the background copy operation. When the FCWITHDR command is executed with DDSW parameter set to YES, the relationships established with the specified copy target extent(s) on the volume specified by SDEVN are withdrawn.

When the FCWITHDR command is executed without any relevant relationships to withdraw, the command will do nothing and end normally. Moreover, the FCWITHDR command will do nothing and end normally when the existing relationships do not fall in with any of the range specified by the XTNTLST parameter.



WARNING! When the relationships are withdrawn by the FCWITHDR command executed with DDSW parameter set to NO or without setting the DDSW parameter, the data integrity of the T-VOL cannot be guaranteed.

Displaying Information on FlashCopy Mirror Version 2 Pairs: FCQUERY

The FCQUERY command can be used to display information including the attributes set to the devices specified by DEVN, and the number of FlashCopy Mirror Version 2 relationships established with the specified devices.

The figure below shows an example of the FCQUERY command. This example requests the information on the device numbered 4202 to be displayed.

```
FCQUERY DVEN('4202')
```

Figure 157 Example of FCQUERY Command Description

The figure below shows the information displayed as a result of executing the command described above. Definition of each displayed information is explained in [Table 112](#).

```
ANTF0090IF CQUERY Formatted
DEVN SSID LSS CCA CU SERIAL ACT MAX XC PC CC
4202 0102 02 02 2105 000000045029 1 3000 N N N
```

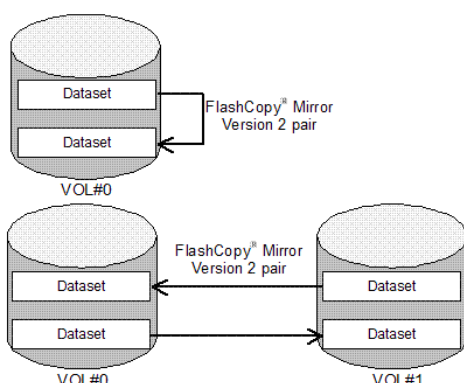
Figure 158 Example of FCQUERY Command Execution Result

Table 112 Information Displayed by FCQUERY Command

Displayed item	Displayed content	Definition
DEVN		Device number recognized by the host
SSID		Subsystem number
LSS		CU number
CCA		Device number
CU		DKC emulation type
SERIAL		Serial number
ACT		Number of active FlashCopy Mirror Version 2 pairs. See Figure 159 .
MAX		Maximum number of pairs that can be created with the device specified by DEVN.
XC	S	Volume specified by DEVN is currently used as an S-VOL of the XRC pair, an At-Time Split volume for SIz, or an asynchronous M-VOL of the TCz pair. Note that if the volume is an asynchronous M-VOL of the TCz pair, the CT type is SYSTEM or NONE , and the pair status is other than Suspend.
	N	Volume specified by DEVN is currently used as the T-VOL of the XRC pair, or not used for XRC

Table 112 Information Displayed by FCQUERY Command (continued)

Displayed item	Displayed content	Definition
PC	P	Volume specified by DEVN is currently used as the S-VOL of the PPRC pair.
	S	Volume specified by DEVN is currently used as the T-VOL of the PPRC pair.
	N	Volume specified by DEVN is currently not used for PPRC.
CC	S	Volume specified by DEVN is currently used as the S-VOL of the Concurrent Copy pair.
	N	Volume specified by DEVN is currently used as the T-VOL of the Concurrent Copy pair, or not used for Concurrent Copy.

**Figure 159** Calculation Example of the Number of the Pairs Displayed in “ACT”

ACT shows the total number of the active FlashCopy Mirror Version 2 pairs in each extent. Therefore, in the example in [Figure 159](#), the total number of the active FlashCopy Mirror Version 2 pairs in the VOL#0 and VOL#1 is both two, and “2” is displayed as the content of ACT.

Cautions on Switching Off the Power Supply When Using Compatible Mirroring for IBM FlashCopy Version 2

The following explains what happens if you power off the disk array during FlashCopy Mirror Version 2 operations and later power on the disk array. What happens depends on the status of the shared memory when powering on the disk array:

- **If data on the shared memory is not volatilized and not lost:**

The status before powering off will be maintained. As for the relationships in COPY mode, background copying will automatically restart when you power on the disk array.

- **If data on the shared memory is volatilized and lost:**

If relationships exist before powering off the disk array, the T-VOLs will become blocked and inaccessible from hosts when you power on the disk array. Thus, the host does not access the inconsistent data in the T-VOLs. To restore the T-VOLs to normal status, force restoration of LDEVs.



WARNING! If data on the shared memory is volatilized and lost after the power turns on, problems may occur during operations. To avoid possible problems, withdraw as much relationships as possible before powering off the disk array.

Suspending FlashCopy Mirror Version 2 Pairs

FlashCopy Mirror Version 2 pairs may be suspended if a hardware or software failure occurs during FlashCopy Mirror Version 2 operation. If FlashCopy Mirror Version 2 pairs are suspended, hosts may be unable to access copy target datasets.

To find whether suspended FlashCopy Mirror Version 2 pairs exist within the volumes, use the ShadowImage z/OS main panel (see ["ShadowImage Main Window"](#) on page 258). If the **Relation(s)** column of the volume list displays **S-Failed** or **T-Failed**, a suspended FlashCopy Mirror Version 2 pair exists within the volume.

To delete a suspended FlashCopy Mirror Version 2 pair, do one of the following:

- Delete the copy target dataset that have the suspended FlashCopy Mirror Version 2 pair (i.e., the dataset that is inaccessible from hosts). The operating system will automatically recognize the pair that has the dataset to be deleted, and will issue the Withdraw command.
- Issue the TSO FCWITHDR command. If the suspended FlashCopy Mirror Version 2 pair can be identified, please issue the FCWITHDR command to its extent. For detailed information about the FCWITHDR command, see ["Withdrawing FlashCopy Mirror Version 2 Pairs: FCWITHDR"](#) on page 335.

Relationship Between Compatible Mirroring for IBM FlashCopy and Compatible Mirroring for IBM FlashCopy Version 2

Table 113 Differences Between FlashCopy Mirror and FlashCopy Mirror Version 2

No.	Compared item	FlashCopy Mirror	FlashCopy Mirror Version 2
1	Required software and memory	ShadowImage for z/OS software FlashCopy Mirror software	ShadowImage for z/OS software FlashCopy Mirror Version 2 software Additional shared memory may also be necessary.
2	Requirement on the capacity of the S-VOL and T-VOL for volume copy operation	S-VOL = T-VOL	S-VOL = T-VOL
3	S-VOL/T-VOL LSS	Can create pairs with only volumes in the same LSS.	Can create pairs with volumes in the same LSS or different LSS.
4	Range of extents	Can create pairs with the entire source and target volumes, or with the copy source and target extents that located at the same position on the source and target volumes.	Can create pairs with the entire source and target volumes, or with the copy source and target extents located at the same or different position on the source and target volumes.
5	Unit used for pair management	Pairs are managed by volume. Even when multiple datasets on the same volume are specified, the number of pair is regarded as 1.	Pairs are managed by the specified extents, or by volume when the entire volume is specified. When multiple datasets are specified on the same volume, each dataset is regarded as a pair.
6	Number of pairs created with a source	1 pair can be created with 1 source volume.	Maximum of 16 pairs can be created with 1 source extent.

Table 113 Differences Between FlashCopy Mirror and FlashCopy Mirror Version 2 (continued)

No.	Compared item	FlashCopy Mirror	FlashCopy Mirror Version 2
7	Requirements for creating pairs	<p>Pairs can be created with simplex Slz volumes. It is also possible to create pairs which specify split or duplex Slz S-VOL or T-VOL as the source.</p> <p>Slz S-VOL that already forms pair with three T-VOLs cannot be specified as S-VOL of a FlashCopy Mirror pair.</p>	<p>Pairs can be created with simplex Slz volumes. It is also possible to create pairs which specify split or duplex Slz S-VOL or T-VOL as the source.</p> <p>Up to 16 FlashCopy Mirror Version 2 pairs can be created by specifying the Slz S-VOL that already forms pair with three T-VOLs.</p>
8	Using with other copy solutions	FlashCopy Mirror pair can share the volume with other copy solutions such as Slz, TCz, XRC, or Concurrent Copy.	FlashCopy Mirror Version 2 pair can share the volume only with Slz.
9	DFSMSdss command	COPYFULL command is used to create a FlashCopy Mirror pair with the entire volume.	<p>COPYFULL command is used to create a FlashCopy Mirror Version 2 pair with the entire volume.</p> <p>COPY DS command is used to create a FlashCopy Mirror Version 2 pair with specified dataset.</p>
10	When DFSMSdss command is issued again during background copy operation	If the copy operation is required for the FlashCopy Mirror volume during the copying process, the normal copy operation will be performed via the host.	If the copy operation is required for the FlashCopy Mirror Version 2 volume during the copying process, DFSMSdss command will withdraw the pair, and create the pair again, and then perform the copy operation.
11	TSO command FCESTABL EXTENTS parameter	Up to 5 extents can be specified.	Up to 32 extents can be specified.
12	TSO command FCESTABL XTNTLST parameter	Not supported.	<p>Extents at different positions can be copied.</p> <p>Up to 32 extents can be specified.</p>
13	TSO command FCWITHDR DDSW parameter	<p>Pairs are withdrawn regardless of whether the copy operation is set to COPY or NOCOPY mode.</p> <p>The DDSW parameter is not supported.</p>	<p>When DDSW = YES: Pairs created with the extents on the device specified by SDEVN are withdrawn. When the pairs created with the source extents which copy mode is set to COPY, the pairs are withdrawn after the background copy is completed.</p> <p>When the pairs created with the source extents which copy mode is set to NOCOPY, the pairs are not withdrawn until switch the copy mode to COPY and complete the background copy. Pairs established with the copy target extents are withdrawn immediately.</p> <p>When DDSW = NO: The pairs created with the extents on the device specified by TDEVN are withdrawn immediately.</p>

Table 113 Differences Between FlashCopy Mirror and FlashCopy Mirror Version 2 (continued)

No.	Compared item	FlashCopy Mirror	FlashCopy Mirror Version 2
14	TSO command FCWITHDR XTNTLST parameter	Not supported.	Can withdraw pairs created with extents located at different positions.
15	Items displayed by FCQUERY command	Whether the volume status is simplex or not. Whether any FlashCopy Mirror pairs are created or not. Rate of progress (%) of background copy.	Number of active pairs. Maximum number of pairs that can be created with the device specified by DEVN.

Differences Between IBM FlashCopy and Compatible Mirroring for IBM FlashCopy Version 2

Table 114 Differences Between IBM FlashCopy and Compatible Mirroring for IBM FlashCopy Version 2

No.	Compared item	IBM FlashCopy	FlashCopy Mirror Version 2
1	Read access to the area not specified as the copy range in the copy target in NOCOPY mode	The data on the tracks subject to read operation are not copied from the copy source to the copy target.	The data on the tracks subject to read operation are copied from the copy source to the copy target.
2	Status of the pairs when On-demand copy is processed	Pairs are withdrawn automatically when all the copy operations processed by On-demand copy are completed.	Pairs are maintained even when all the copy operations processed by On-demand copy are completed.
3	Sharing T-VOL with other copy solutions	Pairs that include the following shared volume can be created: <ul style="list-style-type: none"> PPRC pair that includes a volume used as FlashCopy S-VOL as well as PPRC T-VOL PPRC pair that includes a volume used as FlashCopy T-VOL as well as PPRC S-VOL PPRC pair that includes a volume used as FlashCopy T-VOL as well as PPRC T-VOL 	Not supported.
4	Number of multiple relationships	Up to 12 pairs can be created per extent (the smallest unit: track).	Up to 16 pairs can be created per extent (the smallest unit: track).

Table 114 Differences Between IBM FlashCopy and Compatible Mirroring for IBM FlashCopy Version 2

No.	Compared item	IBM FlashCopy	FlashCopy Mirror Version 2
5	Maximum number of pairs that can be created per volume	951 pairs (for 3390-3) 2,719 pairs (for 3390-9 when the number of available cylinders are 10,017) 7,615 pairs (for 3390-L when the number of available cylinders are 28,356) 8,839 pairs (for 3390-L when the number of available cylinders are 32,760)	3,000 pairs (for all volume types)
6	FCWITHDR command (DDSW = NO, XTNTLST parameter specified)	The command withdraws the copy targets of pairs existing within the extents specified as the target, provided that: <ul style="list-style-type: none">• When the copy target of the pair is only partly included in the extent specified as the target, only the area that is included in the extent is withdrawn.• When only the central part of the copy target of the pair is included in the extent specified as the target, only the area that is included is withdrawn. The remaining area of the pair is divided up.	The command withdraws the copy targets of pairs existing within the extents specified as the target. When the copy target of the pair is only partly included in the extent specified as the target, the command does not withdraw the pair.
7	REMOVEFCPY (ICKDSF CONTROL command)	The command will finish normally. Pairs will not be deleted.	Not supported. The command will finish abnormally. Pairs will not be deleted.

3 HPAV for the XP128/XP1024/XP12000

HPAV (Hitachi Parallel Access Volume) enables a zSeries and S/390 host system to issue multiple I/O requests in parallel to logical devices (LDEVs) on an XP128/XP1024/XP12000. When HPAV is not used, the host system can start only one I/O request to a device at a time and must wait for the I/O to complete before starting another I/O request to the same device. HPAV allows the host system to start multiple I/O requests to the same device at the same time through the alias addresses assigned to a device. When HPAV is used, the zSeries and S/390 host computer has substantially faster access to the data stored in the XP128/XP1024/XP12000.

The two types of devices used in HPAV operations are base devices and alias devices. The base devices are the installed devices that contain user data. The alias devices are installed but are unused devices whose addresses can be used as aliases for the base devices. The XP128/XP1024/XP12000 supports up to 256 devices per logical control unit (CU), including base and alias devices, for a maximum of 8,192 device addresses per disk array.

HPAV on the Command View management station configures HPAV devices on the XP128/XP1024/XP12000, such as assigning aliases to base devices, canceling aliases, and so forth. The Command View management station is attached to and communicates directly with the XP128/XP1024/XP12000 through the LAN.

The Workload Manager (WLM) host software function enables the zSeries and S/390 host to use the HPAV functionality of the XP128/XP1024/XP12000. WLM compatibility mode provides static HPAV functionality and WLM goal mode provides dynamic HPAV functionality. The XP128/XP1024/XP12000 supports both static and dynamic HPAV. When static HPAV is used, the number of aliases assigned to each base device does not change. For dynamic HPAV, the number of aliases assigned to a base device can change depending on the number of host I/O requests to that device. For more information on static and dynamic HPAV, see ["Static and Dynamic HPAV Operations"](#) on page 353.

Overview of HPAV Operations

Components

The components that are involved in HPAV operations are:

- Base devices and alias devices on the disk array (see page 351)
- Controller emulation type for the disk array (see page 352)
- HPAV software enabled on the disk array through the Command View management station (see *Managing license keys and/or Command View-based HPAV in the HP StorageWorks Command View XP for XP Disk Arrays User Guide*)
- Hardware Configuration Definition (HCD) definitions for the disk array (see page 352)
- WLM host software definitions for dynamic alias management (see page 353)

Base Devices and Alias Devices

The XP1024/XP12000 supports a maximum of 8,192 logical devices (LDEVs), up to 256 LDEVs per logical control unit (CU) image and up to 32 CU images. The number of LDEVs per parity group depends on the hard disk drive (HDD) type, RAID level, and device emulation type (for example, 3390-3R) of the parity group. Each LDEV is uniquely identified by its LDEV ID, which consists of the logical CU image

number (0, 1, 2...F) and device number (00-FF hexadecimal) (for example, x0:0F = device 0F in CU image 0).

LDEVs that are formatted as zSeries and OS/390 devices (for example, 3390 or 3380) are called logical volume images (LVIs) or volumes. LDEVs formatted as open system devices (for example, OPEN-3 or OPEN-9) are called logical units (LUs). HPAV operations can be performed only on 3390 LVIs.

The two device types for HPAV operations are:

- **Base device – 3390B:** A base device is a formatted LVI that contains user data and to which one or more alias devices can be assigned. A base device must be defined to the host as a 3390B device type (for example, 3390B-3 or 3390B-9).
- **Alias device – 3390A:** An alias device is a formatted but unused logical device whose LDEV ID (address) can be used as an alias for a base device. Alias devices cannot be modified online. Each alias must be within the same logical CU image as the base device to which it is assigned. An alias device must be defined to the host as a 3390A device type (for example, 3390A-3 or 3390A-9).



NOTE: The 3390A and 3390B devices are not related to the 3390-3A/B/C multiplatform devices.

Controller Emulation Type

The IBM 2105 controller emulation type is required for HPAV operations. Each logical CU image on the XP128/XP1024/XP12000 that contains HPAV base and alias devices must be set for 2105 controller emulation.



NOTE: To configure copy devices and HPAV devices under the same logical CU image, refer to [Table 116 on page 355](#) for important information and instructions. Copy devices include TrueCopy (TC390), PPRC, and XRC devices.

Command View-based HPAV

HPAV running under Command View configures the HPAV devices on XP128/XP1024/XP12000 that have been registered with Command View. HPAV displays the LDEVs in use and the unassigned LDEV IDs that are available for use as aliases. You can use HPAV to assign aliases to base devices and cancel aliases.



NOTE: HPAV will not function for an XP128/XP1024/XP12000 that does not have the HPAV option enabled on it (see [“Enabling the HPAV Options”](#) on page 358).

HCD Definitions for the XP128/XP1024/XP12000 HPAV Devices

The HPAV base and alias devices on the XP128/XP1024/XP12000 must be defined to the host system using HCD. The XP128/XP1024/XP12000 base devices must be 3390B devices (for example, 3390B-3) and the XP128/XP1024/XP12000 alias devices must be 3390A devices (for example, 3390A-3). The required controller emulation for each XP128/XP1024/XP12000 CU image that contains HPAV devices is 2105 emulation. [“Using HCD to Define and View XP128/XP1024/XP12000 LCUs and HPAV Devices”](#) on page 369 provides sample instructions on using HCD to define an HPAV device.



NOTE: The 3390A and 3390B devices are not related to the 3390-3A/B/C multiplatform devices. HPAV operations require that one SSID be set for each set of 256 LDEVs.

WLM Host Software Definitions for Dynamic Alias Management

The Workload Manager (WLM) software component of the MVS/ESA, z/OS, or OS/390 operating system enables the host to interface with the HPAV functionality of the XP128/XP1024/XP12000. WLM compatibility mode provides static HPAV functionality and WLM goal mode provides dynamic HPAV functionality. WLM must be in "GOAL" mode to support "Dynamic Alias Management" HPAV functionality.

Support for Dynamic Alias Management by the Workload Manager (WLM) is dependent on the following three parameter settings:

- WLM Goal Mode setting
- WLM "Dynamic alias management" setting in the Service Coefficients/Service Definitions window (see page 385)
- WLMPAV setting of each base device as defined in the "Define Device Parameters / Features" HCD definition window (see page 379)

Static and Dynamic HPAV Operations

Static or dynamic HPAV operation is determined by the combination of the following parameter settings:

- The 'WLMPAV=xxx' parameter setting for each device defined to the z/OS and OS/390 host through the HCD. The default setting of this parameter is 'WLMPAV=YES' for 3390B or 3390A devices defined through the HCD.
- The 'Dynamic Alias Support' parameter setting for WLM.
- Static HPAV is implemented when the WLM feature for 'Dynamic Alias Support' is set to NO and the appropriate aliases are assigned to the base devices using Command View. The setting of the 'WLMPAV=xxx' parameter defined for each 3390B or 3390A device is ignored. In addition, the 'I/O Priority Management' setting for WLM is ignored (see [Table 115](#)).
- Dynamic HPAV is implemented when 'Dynamic Alias Support' is set to YES and the appropriate aliases are assigned to the base devices using Command View. The setting of the 'WLMPAV=xxx' parameter defined for each 3390B or 3390A device must be set to 'YES' if WLM is to manage the alias device address assignments. In addition, the 'I/O Priority Management' setting for WLM determines the dynamic alias algorithm to be used for meeting the Performance Index of the workloads under the control of WLM using the HPAV feature (see [Table 115](#)).



NOTE: When 'Dynamic Alias Support' is enabled, the alias-to-base assignments are managed by the WLM component of the z/OS and OS/390 system as needed in response to changes in I/O activity.

Table 115 HCD settings for static and dynamic HPAV

Dynamic Alias Support	I/O Priority Management	Dynamic Alias Algorithm in Effect
NO	NO	None (static HPAV only)
NO	YES	None (static HPAV only)

Table 115 HCD settings for static and dynamic HPAV (continued)

Dynamic Alias Support	I/O Priority Management	Dynamic Alias Algorithm in Effect
YES	NO	Efficiency only
YES	YES	Both efficiency and goal

Static HPAV

When static HPAV is used, the number of aliases specified for each base device does not change, even when the number of I/O requests to each device changes. When dynamic HPAV is used, the number of aliases for each base device is likely to change as the number of I/O requests changes.

The following figure shows an example of static HPAV operations. Each of the three base devices (x10, x11, and x12) has two aliases assigned. If I/O requests converge on base device x10 (shown by the large arrow), the number of aliases for each base device remains unchanged.



NOTE: If you will be using static HPAV, determine on which devices I/O requests are likely to converge, and then assign more aliases to those base devices. If not, HPAV might not be able to provide much improvement in host access to data in the XP128/XP1024/XP12000.

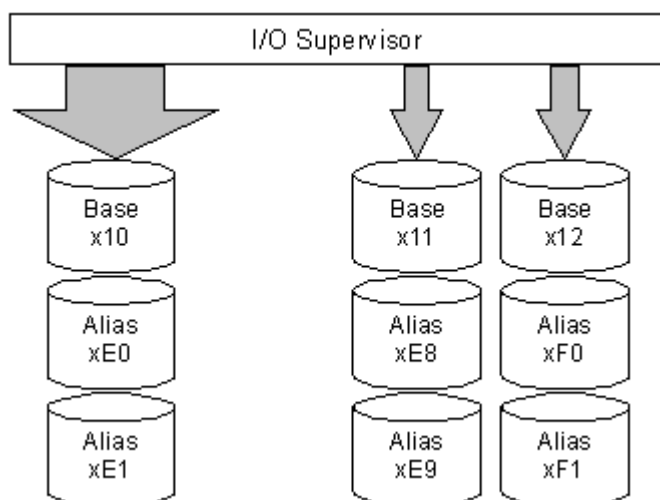


Figure 160 Static HPAV

Dynamic HPAV

When dynamic HPAV is used, the number of aliases for a base device may change as the number of I/O requests to the device changes. If I/O requests converge on several base devices, the number of aliases for these devices may increase, while the number of aliases for other base devices may decrease. Dynamic HPAV operations can balance workloads on base devices and optimize the speed for accessing data in the XP128/XP1024/XP12000.

The following figure shows an example of dynamic HPAV operations. Each of the three base devices (x10, x11, and x12) was originally assigned two aliases. In this example, as I/O requests converge on base device x10 (shown by the large arrow), the number of aliases for device x10 increases to four, while the number of aliases for base device x11 and x12 decreases to one.

Dynamic HPAV operations require the Workload Manager (WLM) software function provided by the host computer. For more information on WLM operations, see ["WLM Host Software Definitions for Dynamic Alias Management"](#) on page 353 and ["System Requirements"](#) on page 357.

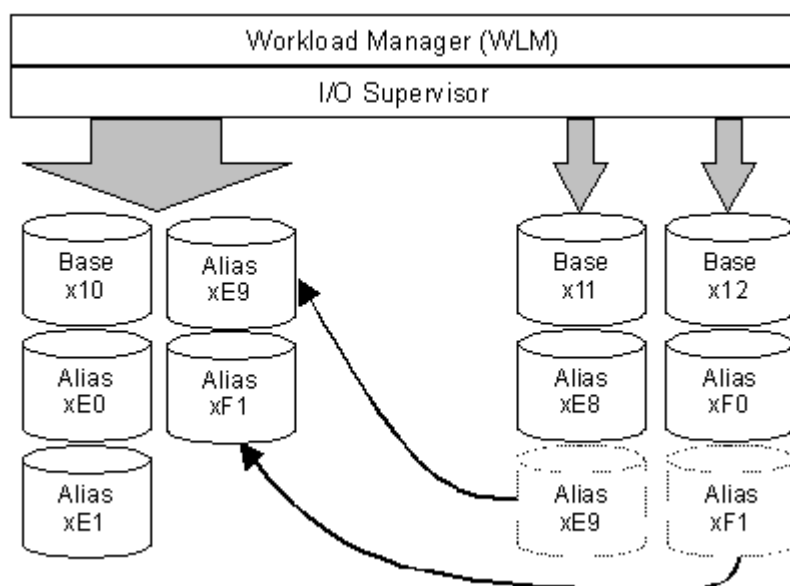


Figure 161 Dynamic HPAV

Requirements and Restrictions

The following table lists the requirements and restrictions for HPAV operations on the XP128/XP1024/XP12000.

Table 116 Requirements and restrictions for HPAV

Item	Requirement and/or Restriction
Controller emulation type	I-2105
Device emulation type for base device	3390-3, 3390-3R, 3390-9, 3390-L
Storage subsystem ID (SSID) setting	One SSID must be set for each set of 256 LDEVs.
Maximum number of aliases that can be assigned to a base device	15
Alias device	Alias device and its base device must belong to the same logical CU image.
Functions that cannot be used concurrently with HPAV	<ul style="list-style-type: none"> • Hitachi Multiplatform Backup/Restore (HMBR) • Virtual LUN • Cache LUN XP • Business Copy (BC) XP • Continuous Access (CA) XP

Table 116 Requirements and restrictions for HPAV (continued)

Item	Requirement and/or Restriction
Functions that can be used concurrently with HPAV	<ul style="list-style-type: none">• Virtual LVI• Hitachi FlashAccess for S/390• SANtinel - S/390• TrueCopy (TC390)• ShadowImage (SI390)• PPRC• Extended Remote Copy (XRC) with restrictions (see <i>Caution</i> below)



CAUTION: The following restrictions apply if XRC will be used with HPAV:

- Ensure that the emulation type of all LCUs is 2105. Do not intermix 2105 emulation with other emulation types within the same disk array.
- If XRC volumes already exist, complete the following steps to change to 2105 emulation:
 - a. Stop all jobs and delete all XRC pairs.
 - b. Change the DKC emulation type of all CHA packages in the disk array to 2105.
 - c. Restart jobs and re-establish XRC pairs.

Maximizing Your HPAV Results

To maximize your results from HPAV operations, be aware of the following:

- The best results can be obtained if the number of aliases per CU image is equal to the number of available channel paths minus one. If the number of aliases is specified this way, I/O operations can use all channel paths, thus providing the best results.
- HPAV may not produce good results when many channel paths are used. If all channel paths are used, good HPAV results cannot be expected.
- The unused device addresses in the XP128/XP1024/XP12000 are used as alias devices. If you use most of the unused device addresses for aliases, you will only have a small amount of free devices available. If you determine that a large number of aliases will be required, consider adding more disks to ensure that storage will be available when needed.
- HPAV may not provide good results for devices that are always shared and used by multiple host systems. For access by multiple hosts, use the Multiple Allegiance (MA) host software function supported by the XP128/XP1024/XP12000.
- If dynamic HPAV can be used in all systems, expect good results if you assign eight to sixteen (8-16) aliases to each CU image.
- The recommended ratio of base devices to alias devices is 1:3. [Table 117](#) shows examples of calculating the number of base and alias devices for a CU image with 256 devices. If you know the types of jobs and/or the expected host access rates for the base devices, determine the number of aliases for each base device to meet your requirements for each base device.

- Up to 255 alias devices can be assigned to one base device. In this case, however, the desired effect will not be achieved because I/O conflicts can occur with the base device and the alias devices. Therefore, the devices may be unable to receive the I/Os.

Table 117 Ratio of base devices to alias devices

Ratio (base devices : alias devices)	Number of Base Devices	Number of Alias Devices	Total Devices
1:3 (recommended)	64	192	256 (64+192)
1:2	85	171 (85+86)	256 (85+171)
1:1	128	128	256 (128+128)

Preparing for HPAV Operations

System Requirements

HPAV operations involve the volumes on the XP128/XP1024/XP12000, the licensed Command View software, and the WLM host software function. The system requirements for HPAV are:

- Host software:
 - **For static HPAV:** OS/390 V1R3 or later, and DFSMS/MVS 1.3 or later VM/ESA 2.4.0 or later.
 - **For dynamic HPAV:** OS/390 V2R7 with APAR OW39854, and DFSMS/MVS 1.5 or later.
 - **APARs and PTFs:** The XP128/XP1024/XP12000 does not have any specific APAR/PTF requirements beyond what is required by the z/OS and OS/390 operating system to provide minimum support for the 2105 device type.
- **XP128/XP1024/XP12000:** The emulation type for a CU image that controls HPAV devices must be 2105 (see ["Changing the Controller Emulation Type"](#) on page 358).
- **IOCP definition considerations:** If you maintain separate IOCP definitions files and create your SCDS or IOCDS manually by running the IZP IOCP program, the following definition rules apply:
 - Each LCU on an XP128/XP1024/XP12000 is defined using one CNTLUNIT statement in IOCP. The unit type is 2105. Up to 16 LCUs can be defined on an XP128/XP1024/XP12000. An LCU is identified by its 'Control Unit Address' ('CUADDR=x' parameter) and is specified as a hexadecimal number in the range of '0' to 'F'. An LCU is the same as an IBM Logical Sub-System or LSS. While it is possible to have an LCU on an XP1024/XP12000 defined using multiple CNTLUNIT statements in IOCP, the resulting input deck cannot be migrated to HCD due to an IBM restriction to allow only one CNTLUNIT definition.
 - Up to 256 devices may be defined on each LCU. Base device addresses are identified as unit type 3390B. Alias device addresses are identified as 3390A.
- **HCD definition considerations:** If you use HCD exclusively to define I/O definitions to z/OS and OS/390 and to automatically run the IOCP program to create SCDS or IOCDS, the following definition rules apply:
 - Each LCU on an XP128/XP1024/XP12000 is defined as a 2105 control unit.
 - Base devices are defined as 3390B device types. HCD will only connect base devices to one control unit. Base device optional parameter definitions in HCD include the 'WLMPAV=xxx' parameter. The default setting is 'YES'.

- Alias devices are defined as 3390A device types. HCD will only connect alias devices to one control unit. Alias devices have only one optional parameter definition in HCD. The 'WLMPAV=xxx' parameter defaults to 'YES'.
- **Command View:** See the *Command View XP Installation Guide*.



NOTE: Administrator access to the Command View management station is required to perform HPAV operations. Users without administrator access can only view HPAV information.

Preparing the XP128/XP1024/XP12000 for HPAV Operations

Changing the Controller Emulation Type

For HPAV operations, the XP128/XP1024/XP12000 must have channel adapter (CHA) packages for which the 2105 emulation type is specified. Ask your HP representative to verify that the correct CHA packages are installed. The HP representative can check and change the controller emulation type in any one of the following ways:

- Add CHA packages and set the emulation type of these packages to 2105 (I-2105).
- Use the System Tuning function on the SVP to change the emulation type to 2105, and then power off and power on the XP128/XP1024/XP12000.



CAUTION: For XRC operations, do not intermix the 2105 emulation type with other emulation types within the same disk array. If the XP128/XP1024/XP12000 is already performing XRC operations, refer to [Table 116 on page 355](#) for instructions on implementing HPAV with these functions on the same disk array.

Enabling the HPAV Options

Set the controller emulation to 2105 (see "[Changing the Controller Emulation Type](#)" on page 358) before enabling the HPAV options. You need to install the HPAV license key through Command View and the HPAV option on each XP128/XP1024/XP12000 that will perform HPAV operations (see Managing license keys in the *HP StorageWorks Command View XP for XP Disk Arrays User Guide*).

Preparing the Host System for HPAV Operations

This section provides a brief description of the required preparations at the host system for HPAV operations on the XP128/XP1024/XP12000. Before performing HPAV operations, you must:

- Set the WLM operation mode on the host system (see page 358)
- Set the MIH timer value on the host system (see page 359)

Setting the WLM Operation Mode

WLM manages workloads on MVS systems and has two operation modes for static and dynamic HPAV:

- **Goal mode:** If you want to use dynamic HPAV, you must set the WLM operation mode to *goal mode*. In goal mode, WLM can assign more or fewer aliases to a base device depending on the host I/O activity to that device, thereby managing the system to meet the performance goal specified before system operations began.
- **Compatibility mode:** If you want to use static HPAV, you must set the WLM operation mode to *compatibility mode*. In compatibility mode, the number of aliases assigned to each base device does

not change as a result of changes in host I/O activity. WLM manages the system according to the parameters in the IPS and ICS (IEAIPSxx and IEAICSxx).

Setting the MIH Timer Value


The recommended MIH timer value for XP128/XP1024/XP12000 HPAV operations is **30 seconds**. The MIH timer values can be set in MVS/ESA, z/OS, or OS/390 either at IPL or after IPL.

To set the MIH timer value:

- **At IPL** – Use the MIH parameter in the IECIOSxx parmlib member to set the MIH timer value at IPL time.
- **After IPL** – Use the “SETIOS” System Command after IPL to change or set the MIH timer value.

Starting HPAV

To access HPAV:

1. From the Launch window, click an XP128, XP1024, or XP12000.
2. Click the **Mainframe** tab, click the **Mainframe Connection** button (), and then click the **HPAV** tab. The HPAV window is displayed.

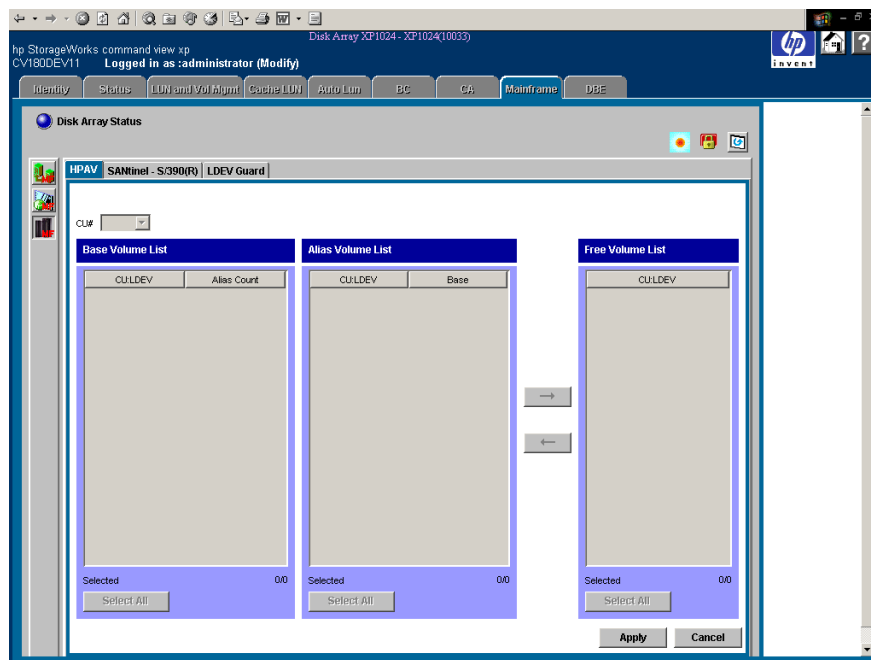


Figure 162 HPAV window

HPAV Window

Use the **CU#** list to select a logical CU image in the connected XP128/XP1024/XP12000. The HPAV window displays the LDEVs (3390 LVIs only) for the selected CU image.

The **Base Volume List** box displays the 3390 LVIs that are currently in use in the selected CU image. Each of these LDEVs can be an HPAV base device. When assigning and canceling aliases for base devices, select the base devices from this list box.

- **Alias Count:** This column indicates the number of aliases for each base volume.

- The **Selected** box displays the number of selected base volumes and the total number of base volumes in the selected CU image. For example, 2/73 indicates that two base volumes are selected out of a total of 73 base volumes in the select CU image.
- Click **Select All** to select all volumes in the Base Volume List box.

The **Alias Volume List** box displays the alias device(s) assigned to the selected base device(s). To view all alias devices for the selected CU image, select all of the base devices. When canceling aliases for base devices, select the alias devices from this list.

- The **Base** column displays the LDEV ID of the base device for each alias device.
- The **Selected** box displays the number of selected alias devices and the total number of alias devices in the selected CU image. For example, 2/4 indicates that two aliases are selected out of a total of four alias devices in the selected CU image.
- Click **Select All** to select all volumes in the Alias Volume List box.

The **Free Volume List** box displays the LDEV IDs of the unused volumes in the selected CU. Each of these free volumes can be used as an HPAV alias device. When assigning aliases to base volumes, select the alias devices from this list.

- The **Selected** box displays the number of selected free devices and the total number of free devices in the selected CU image. For example, 8/47 indicates that eight free devices are selected out of a total of 47 free devices in the selected CU image.
- Click **Select All** to select all volumes in the Free Volume List box.

Clicking the → button cancels aliases for base devices (see “[Canceling Aliases](#)” on page 362). After clicking the → button, the Free Volume List box then displays their LDEV IDs. To complete your request to cancel the aliases as specified, click **Apply**.

Clicking the ← button assigns aliases to base devices (see “[Assigning Aliases](#)” on page 360). After clicking the ← button, the Alias Volume List box displays the new alias devices. To complete your request to assign the new aliases as specified, click **Apply**.

The **Apply** button applies the settings made on this window to the XP128/XP1024/XP12000. Clicking this button displays a message confirming that you want to apply your request to the disk array.

The **Cancel** button discards changes in this window to restore the initial settings.

Performing HPAV Operations

After you have prepared for HPAV operations as described in “[Preparing for HPAV Operations](#)” on page 357, you are ready to start performing HPAV operations on the XP128/XP1024/XP12000. HPAV operations include:

- Assigning and canceling aliases (see page 360)
- Defining the XP128/XP1024/XP12000 devices to the host system (see page 363)

Assigning and Canceling Aliases

Assigning Aliases

Before you assign HPAV aliases, you should have determined the required number of aliases for each base device to meet your operational requirements (see “[Maximizing Your HPAV Results](#)” on page 356). If you assign additional aliases after starting I/O operations to the XP128/XP1024/XP12000 HPAV devices, you will need to redefine the XP128/XP1024/XP12000 HPAV devices to the host operating system.

You can assign up to 15 aliases to one base device. The HPAV assign alias function pairs each selected base volume with one or more of the selected free volumes. If the number of selected free volumes is larger than the number of selected base volumes, this function attempts to allocate the free volumes equally to the base volumes. For example, if six free volumes and two base volumes are selected, three free volumes (aliases) are allocated to each base volume.

To assign aliases to volumes in the connected XP128/XP1024/XP12000:

1. From the HPAV window, click the CU image that contains the base volumes. The Free Volume List box displays the total number of available free volumes.
2. To add the new aliases to the Alias Volume List box, click the base volumes in the Base Volume List box, click the free volumes in the Free Volume List box, and then click the ← button.

To assign one alias to each base volume, select the same number of free volumes as base volumes.

To assign three aliases to each base volume, select three times as many free volumes as base volumes (for example, 3 base volumes and 9 free volumes).

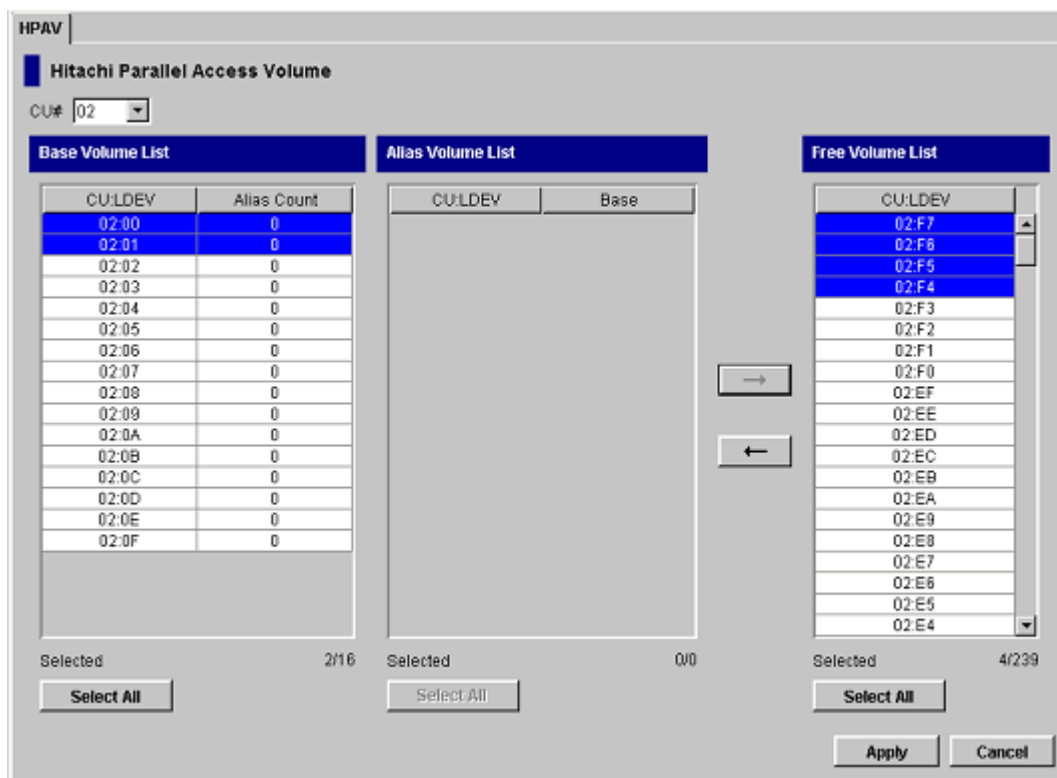


Figure 163 Assigning aliases

- Click **Apply** on the HPAV window. When the Set HPAV confirmation dialog box is displayed, click **OK** to assign the new aliases as specified. To cancel your request, click **Cancel**.

HPAV
Hitachi Parallel Access Volume

CU# 02

Base Volume List		Alias Volume List		Free Volume List
CU:LDEV	Alias Count	CU:LDEV	Base	CU:LDEV
02:00	2	02:F7	02:00	02:F3
02:01	2	02:F6	02:00	02:F2
02:02	0	02:F5	02:01	02:F1
02:03	0	02:F4	02:01	02:F0
02:04	0			02:EF
02:05	0			02:EE
02:06	0			02:ED
02:07	0			02:EC
02:08	0			02:EB
02:09	0			02:EA
02:0A	0			02:E9
02:0B	0			02:E8
02:0C	0			02:E7
02:0D	0			02:E6
02:0E	0			02:E5
02:0F	0			02:E4
				02:E3
				02:E2
				02:E1
				02:E0

Selected 2/16 Selected 4/4 Selected 0/235

Select All Select All Select All

Apply Cancel

Figure 164 Confirming new aliases

Canceling Aliases



CAUTION: Do not cancel aliases while I/O operations are being performed on the HPAV devices. This can cause a serious failure.

To cancel aliases for volumes in the connected XP128/XP1024/XP12000:

- From the HPAV window, click the CU image that contains the aliases that you want to cancel.
- In the Base Volume List box, click the base device(s) for the aliases that you want to cancel.
- In the Alias Volume List box, click the alias devices that you want to cancel and then click the → button to remove the aliases from the Alias Volume List box and add their LDEV IDs to the Free Volume List box.

- Click **Apply** on the HPAV window. When the Set HPAV confirmation dialog box is displayed, click **Yes** to cancel the aliases as specified. To cancel your request, click **No**.

HPAV

Hitachi Parallel Access Volume

CU# 02

Base Volume List

CU:LDEV	Alias Count
02:00	2
02:01	2
02:02	0
02:03	0
02:04	0
02:05	0
02:06	0
02:07	0
02:08	0
02:09	0
02:0A	0
02:0B	0
02:0C	0
02:0D	0
02:0E	0
02:0F	0

Selected 2/16

Select All

Alias Volume List

CU:LDEV	Base
02:FF	02:00
02:FE	02:00
02:FD	02:01
02:FC	02:01

Selected 2/4

Select All

Free Volume List

CU:LDEV
02:FB
02:FA
02:F9
02:F8
02:F7
02:F6
02:F5
02:F4
02:F3
02:F2
02:F1
02:F0
02:EF
02:EE
02:ED
02:EC
02:EB
02:EA
02:E9
02:E8

Selected 0/235

Select All

Apply Cancel

Figure 165 Canceling aliases

Considerations for Defining the XP128/XP1024/XP12000 Devices to the Host System

For XRC, do not intermix the 2105 controller emulation type with other emulation types within the XP128/XP1024/XP12000. If the XP128/XP1024/XP12000 has existing XRC volumes and you want to implement HPAV, complete the following steps to change to 2105 emulation:

- Stop all jobs and delete all XRC pairs.
- Change the DKC emulation type of all CHA packages in the XP128/XP1024/XP12000 to I-2105.
- Restart jobs and re-establish XRC pairs.



NOTE: HPAV operations require that one SSID be set for each set of 256 LDEVs.

Definition of XP128/XP1024/XP12000 Base and Alias Devices

The unit address mapping for base and alias devices must be defined to the host operating system and must match the address mapping defined at the Command View management station. If the mappings do not match, serious failures can occur during data processing. The following shows examples of mappings between base devices and alias devices.

- | | | | | | | | |
|-----|---------------|-----|---------------|-----|---------------|-----|---------------|
| (A) | x00-x3F:Base | (B) | x00-x3F:Base | (C) | x00-x7F:Alias | (D) | x00-x3F:Alias |
| | x40-xFF:Alias | | x40-x7F:Alias | | x80-xFF:Base | | x40-x7F:Base |
| | | | x80-xBF:Base | | | | x80-xBF:Alias |
| | | | xC0-xFF:Alias | | | | xC0-xFF:Base |



NOTE: When each base device is assumed to be assigned the same number of aliases, the recommended ratio of base devices to aliases is 1:3.

Verifying Base and Alias Device Definition

After defining the mapping between base devices and alias devices to the host operating system (see ["Definition of XP128/XP1024/XP12000 Base and Alias Devices"](#) on page 363), verify that the host recognizes the XP128/XP1024/XP12000 devices as specified.

To verify that the host system recognizes the settings for the XP128/XP1024/XP12000 base and alias devices:

1. At the MVS console display information about the base devices and the corresponding alias addresses using the DEVSERV (DS) command. See ["Example: Verifying the Base Devices and Alias Addresses"](#) on page 364.

DS QPAV, XXXX,VOLUME (XXXX = address of the base device)

2. Verify that the information displayed by the DS command matches your definitions of base devices and alias addresses.



NOTE: The information displayed by the DS command should match the HPAV settings that you specified at the Command View management station for base devices and alias addresses. If it does not match, redefinition is required. After dynamic HPAV has been used, the information may not match, but the mismatch will not cause any problems. For dynamic HPAV, the mismatch occurs because the host system can change the number of aliases assigned to each base device.

Example: Verifying the Base Devices and Alias Addresses

```
DS QPAV, D222,VOLUME
IEE459I 08:20:32 DEVSERV QPATHS 591
Host                               Subsystem
Configuration                      Configuration
-----
UNIT  UNIT  UA                      UNIT
NUM  UA    TYPE                     SSID  ADDR  TYPE
---  ---  ---                     ---  ---  ---
D222  22    BASE                     0102  22    BASE
D2FE  FE    ALIAS-D222                0102  FE    ALIAS-22
D2FF  FF    ALIAS-D222                0102  FF    ALIAS-22
***3 DEVICE(S) MET THE SELECTION CRITERIA
```

Verifying the Status of the Devices

After verifying the generation definition for the XP128/XP1024/XP12000 devices, verify the status of the devices for each channel path (CHP).

To verify the status of the XP128/XP1024/XP12000 devices by CHP ID:

1. At the MVS console display the status of the XP128/XP1024/XP12000 devices by issuing the Display Matrix command for each CHPID connected to the XP128/XP1024/XP12000. See ["Example: Verifying the Status of Devices Defined by CHP ID"](#) on page 365.

D M=CHP(XX) (XX = CHP ID)

2. Verify that the displayed information matches the device status that was defined when the generation definition was made:
 - If the information is correct, the XP128/XP1024/XP12000 is now ready for HPAV activities. For information on monitoring HPAV activities, see ["Monitoring HPAV Activities"](#) on page 365.
 - If the information is not correct, redefine the XP128/XP1024/XP12000 devices to the host as described in ["Definition of XP128/XP1024/XP12000 Base and Alias Devices"](#) on page 363 and ["Verifying Base and Alias Device Definition"](#) on page 364.

Example: Verifying the Status of Devices Defined by CHP ID

D M=CHP(80)																
IEE174I 10.05.24 DISPLAY M 779																
CHPID 80:TYPE=05, DESC=ESCON SWITCHED POINT TO POINT																
DEVICE STATUS FOR CHANNEL PATH 80																
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
680	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
681	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
682	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
683	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
684	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL
685	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL
686	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL
687	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL
688	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
689	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
68A	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
68B	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
68C	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
68D	UL	UL	UL	UL	UL	UL	AL	AL	AL	AL	AL	AL	AL	AL	AL	AL
68E	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
68F	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
*****SYMBOL EXPLANATIONS*****																
+ ONLINE @ PATH NOT VALIDATED - OFFLINE .DOES NOT EXIST																
* PHYSICALLY ONLINE \$ PATH NOT OPERATIONAL																
BX DEVICE IS BOXED SN SUBCHANNEL NOT AVAILABLE																
DN DEVICE NOT AVAILABLE PE SUBCHANNEL IN PERMANENT ERROR																
AL DEVICE IS AN ALIAS UL DEVICE IS AN UNBOUND ALIAS																

Monitoring HPAV Activities

The following methods can be used to monitor HPAV activities on the XP128/XP1024/XP12000:

- Additional MVS commands
- GTF I/O tracing

Additional MVS Commands

In addition to the "DS QPAV" and "D M=CHP" commands (see the examples on page 364 and page 365), the following commands will provide additional information:

- **DISPLAY M=DEV.** ["Example: Display Command – HPAV Base Device with 5 Aliases"](#) on page 366 shows an example of the Display M=DEV(xxxx) command for a base device.

- **DEVSERV PATHS.** "Example: [DEVSERV DISPLAY PATHS Command](#)" on page 366 shows an example of a DEVSERV PATHS command.
- **DEVSERV QPAV.** "Example: [DEVSERV QPAV Command](#)" on page 367, "Example: [DSESERV QPAV,SSID=xxxx Command](#)" on page 368, and "Example: [DS QP,8300,VOLUME Command](#)" on page 369 show examples of the DEVSERV QPAV commands having the following command formats:
 - DS QP,8300,4: Display status of four base devices starting at device 8300.
 - DS QP,SSID=8300: Display status of entire Subsystem-ID.
 - DS QP,8300,VOLUME: Display status of host/subsystem configuration for volume.

GTF I/O Tracing

GTF is PAV aware. When a device number is specified for GTF I/O tracing operations, GTF determines if the device is a base PAV device and will automatically include the Alias addresses currently bound to the base device.

Example: Display Command – HPAV Base Device with 5 Aliases

```
D M=DEV(8300)
IEE174I 15.33.58 DISPLAY M 739
DEVICE 8300 STATUS=ONLINE
CHP                63 40 64 65
DEST LINK ADDRESS  DD EA E9 E8
DEST LOGICAL ADDRESS 02 02 02 02
PATH ONLINE        N  Y  Y  Y
CHP PHYSICALLY ONLINE Y  Y  Y  Y
PATH OPERATIONAL    N  Y  Y  Y
MANAGED             N  N  N  N
MAXIMUM MANAGED CHPID(S) ALLOWED:  0
ND                  = 002105. .HTC.02.000000012345
DEVICE NED =        2105. .HTC.02.000000012345
PAV BASE AND ALIASES  6
```

Example: DEVSERV DISPLAY PATHS Command

```
DS P,8300
IEE459I 15.43.32 DEVSERV PATHS 755
UNIT DTYPE  M CNT VOLSER  CHPID=PATH STATUS
      RTYPE  SSID CFW TC   DFW  PIN  DC-STATE CCA  DDC   ALT  CU-TYP
8300,33903 ,0,000,PA8300,63=< 40=+ 64=+ 65=+
      2105   8300 Y YY. YY.   N  SIMPLEX  00  00      2105
***** SYMBOL DEFINITIONS *****
O = ONLINE                      + = PATH AVAILABLE
< = PHYSICALLY UNAVAILABLE
```

Example: DEVSERV QPAV Command

```
DS QP,8300,4
IEE459I 15.50.16 DEVSERV QPAVS 013

      HOST                                SUBSYSTEM
CONFIGURATION                            CONFIGURATION
-----
UNIT                                     UNIT    UA
NUM. UA  TYPE          STATUS          SSID ADDR.  TYPE
-----
8300 00  BASE          -----          8300  00  BASE
8301 01  BASE          8300  01  BASE
8302 02  BASE          8300  02  BASE
8303 03  BASE          8300  03  BASE

****          4 DEVICE(S) MET THE SELECTION CRITERIA
```

Example: DSESERV QPAV,SSID=xxxx Command

```

DS QP,SSID=8300
IEE459I 15.56.03 DEVSERV QPAVS 026

      HOST                      SUBSYSTEM
      CONFIGURATION              CONFIGURATION
      -----
UNIT                                UNIT    UA
NUM. UA  TYPE          STATUS      SSID  ADDR.  TYPE
----- --  ----          -
8300 00  BASE                      8300   00    BASE
8301 01  BASE                      8300   01    BASE
8302 02  BASE                      8300   02    BASE
8303 03  BASE                      8300   03    BASE
8304 04  BASE                      8300   04    BASE
8306 06  BASE                      8300   06    BASE
8307 07  BASE                      8300   07    BASE
8308 08  BASE                      8300   08    BASE
8309 09  BASE                      8300   09    BASE
830A 0A  BASE                      8300   0A    BASE
830C 0C  BASE                      8300   0C    BASE
830D 0D  BASE                      8300   0D    BASE
830E 0E  BASE                      8300   0E    BASE
830F 0F  BASE                      8300   0F    BASE
8310 10  BASE                      8300   10    BASE
8311 11  BASE                      8300   11    BASE
8312 12  BASE                      8300   12    BASE
8313 13  BASE                      8300   13    BASE
8314 14  BASE                      8300   14    BASE
8315 15  BASE                      8300   15    BASE
8316 16  BASE                      8300   16    BASE
8317 17  BASE                      8300   17    BASE
8318 18  BASE                      8300   18    BASE
8319 19  BASE                      8300   19    BASE
831A 1A  BASE                      8300   1A    BASE
831B 1B  BASE                      8300   1B    BASE
831D 1D  BASE                      8300   1D    BASE
831F 1F  BASE                      8300   1F    BASE
8320 20  BASE                      8300   20    BASE
8321 21  BASE                      8300   21    BASE
8322 22  BASE                      8300   22    BASE
83F6 F6  ALIAS-8301                8300   F6    ALIAS-01
83F7 F7  ALIAS-8301                8300   F7    ALIAS-01
83F8 F8  ALIAS-8301                8300   F8    ALIAS-01
83F9 F9  ALIAS-8301                8300   F9    ALIAS-01
83FA FA  ALIAS-8301                8300   FA    ALIAS-01
83FB FB  ALIAS-8300                8300   FB    ALIAS-00
83FC FC  ALIAS-8300                8300   FC    ALIAS-00
83FD FD  ALIAS-8300                8300   FD    ALIAS-00
83FE FE  ALIAS-8300                8300   FE    ALIAS-00
83FF FF  ALIAS-8300                8300   FF    ALIAS-00
****          41 DEVICE(S) MET THE SELECTION CRITERIA

```


Example: DS QP,8300,VOLUME Command

```
DS QP,8300,VOLUME
IEE459I 16.00.15 DEVSERV QPAVS 041

      HOST                      SUBSYSTEM
      CONFIGURATION            CONFIGURATION
      -----
UNIT                                UNIT    UA
NUM. UA  TYPE          STATUS      SSID ADDR.  TYPE
----- --  ---
8300 00  BASE
83FB FB  ALIAS-8300
83FC FC  ALIAS-8300
83FD FD  ALIAS-8300
83FE FE  ALIAS-8300
83FF FF  ALIAS-8300
****          6 DEVICE(S) MET THE SELECTION CRITERIA
```

Using HCD to Define and View XP128/XP1024/XP12000 LCUs and HPAV Devices

The XP128/XP1024/XP12000 logical control units (LCUs) and PAV base and alias devices are defined to MVS/ESA and OS/390 systems using the configuration dialog windows of the Hardware Configuration Definition (HCD) Program. The HCD Program can also display the WLMPAV device parameter for existing HPAV devices.

This section provides sample instructions for:

- Defining an XP1024/XP12000 LCU and base and alias HPAV devices (see page 369)
- Displaying the WLMPAV device parameters (see page 379)

Using HCD to Define an XP1024/XP12000 LCU and the Base and Alias Devices

The following example shows the sequence of HCD windows used in defining an XP1024/XP12000 LCU and a range of base and alias devices. Before you can define the LCU, the channel paths must already be defined.

To define an XP1024/XP12000 LCU and the base and alias address range that it will support, use the following example for HCD:

1. From an ISPF/PDF primary options menu, select the HCD option to display the Basic HCD window. On this window, verify the name of the IODF or IODF.WORK I/O definition file to be used.
2. From the Basic HCD window, select option 1 to display the Define, Modify, or View Configuration Data window (see the following example).

Example: Basic HCD Window

```
OS/390 Release 9 HCD
Command ==>

Hardware Configuration

Select one of the following.

_1  1. Define, modify, or view configuration data  ← Select option 1.
    2. Activate or process configuration data
    3. Print or compare configuration data
    4. Create or view graphical configuration report
    5. Migrate configuration data
    6. Maintain I/O definition files
    7. Query supported hardware and installed UIMs
    8. Getting started with this dialog
    9. What's new in this release

For options 1 to 5, specify the name of the IODF to be used.

I/O definition file . . . 'SYS1.IODF00'
```

3. From the Define, Modify, or View Configuration Data window, select option 4 to display the Add Control Unit window (see the following example).

Example: Define, Modify, Or View Configuration Data

```
----- Define, Modify, or View Configuration Data -----

Select type of objects to define, modify, or view data.

_4  1. Operating system configurations  ← Select option 4.
    consoles
    system-defined generics
    EDTs
    esoterics
    user-modified generics
    2. Switches
        ports
        switch configurations
        port matrix
    3. Processors
        partitions
        channel paths
    4. Control units
    5. I/O devices

F1=Help   F2=Split   F3=Exit   F9=Swap   F12=Cancel
```

- From the Add Control Unit window, enter the following information: Control unit number, Control unit type – 2105, and Switch connection information (see the following example).

Example: Add Control Unit window

```

Goto  Filter  Backup  Query  Help
-----
                                Control Unit List

Command ===> _____ Scroll ===> CSR

Select one or more control units, then press Enter.  To add, use F11.

/ CU   Type +          #PR #MC Serial-# + Description
_ 002 .----- Add Control Unit -----
_ 004 |
_ 006 |
_ 008 | Specify or revise the following values.
_ 03E |
_ 074 | Control unit number . . . . 2000 +
_ 082 | Control unit type . . . . 2105_____ +
_ 0E2 |
_ 240 | Serial number . . . . . _____
_ 240 | Description . . . . . _____
_ 300 |
_ 300 | Connected to switches . . . _ _ _ _ _ _ _ _ _ _ +
_ 300 | Ports . . . . . _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ +
_ 300 |
_ 300 | If connected to a switch:
_ 300 |
_ 300 | Define more than eight ports . . 2  1. Yes
_ 300 |                                     2. No
_ 300 | Propose CHPID/link addresses and
_ 300 | unit addresses . . . . . 2  1. Yes
_ 310 |                                     2. No
_ 310 | F1=Help   F2=Split  F3=Exit   F4=Prompt  F5=Reset  F9=Swap
_ 310 | F12=Cancel
_ 310 '-----'
_ 310 .-----. _____
_ 310 | New IODF SDIODF.IODF07.WORK defined. | _____
_ 310 '-----'
_ 3108 SCTC      1      _____
_ 3109 SCTC      1      _____
_ 310A SCTC      1      _____
_ 4000 2105      1      _____
_ 4100 2105      1      _____

F1=Help   F2=Split  F3=Exit   F4=Prompt  F5=Reset  F7=Backward
F8=Forward F9=Swap   F10=Actions F11=Add    F12=Cancel  F13=Instruct
F22=Command

```

- After defining the control unit, select the processor complex that the control unit is to be attached to (see the following example), and then select option 1 (see ["Example: Select, Change Option"](#) on page 373).

Example: Selecting the Operating System

```

Goto  Filter  Backup  Query  Help
.----- Select Processor / Control Unit -----
|                                     Row 1 of 1 More:      > |
| Command ==> _____ Scroll ==> CSR                |
|                                                         |
| Select processors to change CU/processor parameters, then press Enter. |
|                                                         |
| Control unit number . . : 2000      Control unit type . . . : 2105 |
|                                                         |
|           Log. Addr. -----Channel Path ID . Link Address + ----- |
| / Proc. ID Att. (CUADD) + 1---- 2---- 3---- 4---- 5---- 6---- 7---- 8---- |
| _ SYSTEMS      _      _      _      _      _      _      _      _      |
| ***** Bottom of data ***** |
|                                                         |
| F1=Help      F2=Split      F3=Exit      F4=Prompt      F5=Reset |
| F6=Previous  F7=Backward  F8=Forward  F9=Swap      F12=Cancel |
| F20=Right    F22=Command |
|-----|
_ 3007 SCTC      1      _____
_ 3008 SCTC      1      _____
_ 3009 SCTC      1      _____
_ 300A SCTC      1      _____
_ 3101 SCTC      1      _____
_ 3102 SCTC      1      _____
_ 3103 SCTC      1      _____
_ 3104 SCTC      1      _____
_ 3105 SCTC      1      _____
_ 3106 SCTC      1      _____
_ 3107 SCTC      1      _____
_ 3108 SCTC      1      _____
_ 3109 SCTC      1      _____
_ 310A SCTC      1      _____
_ 4000 2105      1      _____
_ 4100 2105      1      _____
F1=Help      F2=Split      F3=Exit      F4=Prompt      F5=Reset      F7=Backward
F8=Forward    F9=Swap      F10=Actions  F11=Add      F12=Cancel  F13=Instruct
F22=Command

```

Example: Select, Change Option

```

Goto  Filter  Backup  Query  Help
.----- Select Processor / Control Unit -----
|
| Command ==> .----- Actions on selected processors -----
|
| Select proces |
|               | Select by number or action code and press Enter.
| Control unit  |
|               |  __  1.  Select (connect, change) . . . . . (s)
|               |      2.  Group connect . . . . . (g)
| / Proc. ID At |      3.  Disconnect . . . . . (n)
| / SYSTEMS     |
| *****      |
|               | F1=Help    F2=Split  F3=Exit   F9=Swap   F12=Cancel
|               | -----
|
|
|
|
|
|
|
|
| F1=Help      F2=Split    F3=Exit    F4=Prompt  F5=Reset
| F6=Previous  F7=Backward F8=Forward F9=Swap    F12=Cancel
| F20=Right    F22=Command
|
|-----
_ 3007 SCTC      1      _____
_ 3008 SCTC      1      _____
_ 3009 SCTC      1      _____
_ 3109 SCTC      1      _____
_ 310A SCTC      1      _____
_ 4000 2105      1      _____
_ 4100 2105      1      _____
F1=Help    F2=Split    F3=Exit    F4=Prompt    F5=Reset    F7=Backward
F8=Forward  F9=Swap    F10=Actions F11=Add     F12=Cancel  F13=Instruct
F22=Command

```

6. Enter chpids that attach to the control unit, the logical control unit address, the device starting address, and the number of devices supported (see the following example).

Example: Control Unit Chpid, CUADD, and Device Address Range Addressing

```

Goto  Filter  Backup  Query  Help
----- Select Processor / Control Unit -----
|
| C ----- Add Control Unit -----
| |
| S |
| | Specify or revise the following values.
| C |
| | Control unit number . : 2000          Type . . . . . : 2105
| | Processor ID . . . . . : SYSTEMS
| / |
| / | Channel path IDs . . . . 31   32   33   34   54   55   56   57   +
| * | Link address . . . . . _   _   _   _   _   _   _   _   +
| |
| | Unit address . . . . . 00   _   _   _   _   _   _   _   +
| | Number of units . . . . 256   _   _   _   _   _   _   _
| |
| | Logical address . . . . 0_   + (same as CUADD)
| |
| | Protocol . . . . . _   + (D,S or S4)
| | I/O concurrency level . 2   + (1, 2 or 3)
| |
| F |
'-- | F1=Help      F2=Split      F3=Exit      F4=Prompt      F5=Reset      F9=Swap
_ 3 | F12=Cancel
_ 3 '-----
_ 3009 SCTC          1          _____
_ 4000 2105          1          _____
_ 4100 2105          1          _____
F1=Help      F2=Split      F3=Exit      F4=Prompt      F5=Reset      F7=Backward
F8=Forward    F9=Swap      F10=Actions  F11=Add        F12=Cancel    F13=Instruct
F22=Command

```

7. Return to the Define, Modify, or View Configuration Data window, and select option 5 to display the I/O Device List window (see the following example).

Example: Define, Modify, Or View Configuration Data

```

----- Define, Modify, or View Configuration Data -----

Select type of objects to define, modify, or view data.

_5  1. Operating system configurations  ← Select option 5.
    consoles
    system-defined generics `
    EDTs
    esoterics
    user-modified generics
  2. Switches
    ports
    switch configurations
    port matrix
  3. Processors
    partitions
    channel paths
  4. Control units
  5. I/O devices

F1=Help  F2=Split  F3=Exit  F9=Swap  F12=Cancel

```

8. From the I/O Device List window, press F11 to start the Add Device dialog (see the following example).

Example: I/O Device List

```

Goto  Filter  Backup  Query  Help

-----
-
>                                     I/O Device List      Row 4854 of 9653 More:
Command ==>> _____ Scroll ==>> CSR

Select one or more devices, then press Enter. To add, use F11. ← Press F11.

-----Device----- --#-- -----Control Unit Numbers + -----
/ Number Type +      PR OS 1--- 2--- 3--- 4--- 5--- 6--- 7--- 8--- Base
_ 8100  3390B        1  1  8100 _____
_ 8102  3390B        1  1  8100 _____
_ 8103  3390B        1  1  8100 _____
_ 8104  3390B        1  1  8100 _____
_ 8105  3390B        1  1  8100 _____
_ 8106  3390B        1  1  8100 _____
_ 8107  3390B        1  1  8100 _____
_ 8108  3390B        1  1  8100 _____
_ 8109  3390B        1  1  8100 _____
_ 810A  3390B        1  1  8100 _____
_ 810B  3390B        1  1  8100 _____
_ 810C  3390B        1  1  8100 _____

```

9. From the Add Device window, enter the following: Device number, Number of devices, Device type: 3390B for an HPAV base device, or 3390A for an HPAV alias device (see the following example).

Example: Add Device

```

                                Add Device

Specify or revise the following values.

Device number . . . . . 8101 (0000 - FFFF)      ← Enter device number.
Number of devices . . . . . 1_____            ← Enter # of devices.
Device type . . . . . 3390B_____              ← Enter device type.

Serial number . . . . . _____
Description . . . . . HP XP1024/XP12000 _____ ← Enter description.

Volume serial number . . . . . _____ (for DASD)

Connected to CUs . . 8100 _____ ← Enter CU.

F1=Help      F2=Split    F3=Exit    F4=Prompt    F5=Reset    F9=Swap
F12=Cancel -
```

10. After the device is defined using the Add Device window, add this device to a specific Processor/System-ID combination. "Example: Device / Processor Definition Window – Selecting the Processor ID" on page 376, "Example: Define Device / Processor Window" on page 377, "Example: Device / Processor Definition Window" on page 377, and "Example: Define Device to OS Configuration Window – Selecting the OS Configuration" on page 378 show the HCD windows used to select the Processor and System-ID to which this device will be added.

Example: Device / Processor Definition Window – Selecting the Processor ID

```

                                Device / Processor Definition
                                Row 1 of 1
Command ==> _____ Scroll ==> CSR

Select processors to change device/processor definitions, then press
Enter.

Device number . . . : 8101      Number of devices . . : 1
Device type . . . : 3390B

                                Preferred Explicit Device
/ Processor ID  UA + Time-Out STADET CHPID + Candidate List
/ SYSTEM#S     _  No      Yes   _      No ← Select processor.
***** Bottom of data *****

F1=Help      F2=Split    F3=Exit    F4=Prompt    F5=Reset
F6=Previous  F7=Backward F8=Forward F9=Swap      F12=Cancel
F22=Command
```


Example: Define Device / Processor Window

```
Define Device / Processor

Specify or revise the following values.

Device number   . . : 8101           Number of devices . . . . : 1
Device type     . . : 3390B
Processor ID    . . : SYSTEM#S       Lab System - F9 - Skyline

Unit address . . . . . 01 + (Only necessary when different from
                           the last 2 digits of device number)

Time-Out . . . . . No (Yes or No)
STADET . . . . . Yes (Yes or No)

Preferred CHPID . . . . . _ +
Explicit device candidate list . No (Yes or No)

F1=Help    F2=Split    F3=Exit    F4=Prompt    F5=Reset    F9=Swap
F12=Cancel -
```

Example: Device / Processor Definition Window

```
Device / Processor Definition

Row 1 of 1
Command ==> _____ Scroll ==> CSR

Select processors to change device/processor definitions, then press
Enter.

Device number   . . : 8101           Number of devices . . : 1
Device type     . . : 3390B

Preferred Explicit Device
/ Processor ID  UA + Time-Out STADET CHPID + Candidate List
/ SYSTEM#S      01   No       Yes   _   No ← Select processor.
***** Bottom of data *****

F1=Help    F2=Split    F3=Exit    F4=Prompt    F5=Reset
F6=Previous F7=Backward F8=Forward F9=Swap      F12=Cancel
F22=Command
```

Example: Define Device to OS Configuration Window – Selecting the OS Configuration

```
Define Device to Operating System Configuration
Row 1 of 1
Command ==> _____ Scroll ==> CSR

Select OSs to connect or disconnect devices, then press Enter.

Device number . : 8101          Number of devices : 1
Device type   . . : 3390B

/ Config. ID  Type      Description                      Defined
/ LABSYSTM    MVS       OS Configuration List (EDT's)  ← Select OS.
***** Bottom of data *****

F1=Help      F2=Split    F3=Exit      F4=Prompt    F5=Reset
F6=Previous  F7=Backward  F8=Forward   F9=Swap      F12=Cancel
F22=Command
```

11. After selecting the OS configuration on the Define Device to Operating System Configuration window (see the previous example), select option 1 to select the device or disconnect the device from the selected OS (see the following example).

Example: Select / Disconnect Option

```
Actions on selected operating systems

Select by number or action code and press Enter.

_1  1.  Select (connect, change) . . . . . (s)  ← Select option 1.
     2.  Disconnect from OS . . . . . (n)

F1=Help      F2=Split    F3=Exit      F9=Swap      F12=Cancel -
```

12. The Define Device Parameters / Features window displays the default device parameters (see the following example).



NOTE: The WLMPAV parameter defaults to Yes.

Example: Define Device Parameters / Features

```
Define Device Parameters / Features                                     Row 1 of 6
Command ==> _____ Scroll ==> CSR

Specify or revise the values below.

Configuration ID . : LABSYSTM      OS Configuration List (EDT's)
Device number   . . : 8101         Number of devices   : 1
Device type     . . . : 3390B

Parameter/
Feature      Value   P Req.  Description
OFFLINE      No      P       Device considered online or offline at IPL
DYNAMIC      Yes      P       Device supports dynamic configuration
LOCANY       No      P       UCB can reside in 31 bit storage
WLMPAV       Yes      P       Device supports work load manager ← WLMPAV parameter.
SHARED       Yes      P       Device shared with other systems
SHAREDUP     No      P       Shared when system physically partitioned
***** Bottom of data *****

F1=Help      F2=Split    F3=Exit      F4=Prompt    F5=Reset
F7=Backward  F8=Forward  F9=Swap      F12=Cancel   F22=Command -
```

Displaying HPAV Device Parameters

You can display the device parameters using HCD to determine if a specific device is eligible for Dynamic HPAV management by WLM. To display the device parameters:

1. Starting from the I/O Device List window, select the device by entering a "/" by the device number. The example shows device 8101 selected (see the following example).

Example: Device Selection Display

```

Goto  Filter  Backup  Query  Help
-----
                                I/O Device List      Row 4854 of 9653 More:      >
Command ====> _____ Scroll ====> CSR

Select one or more devices, then press Enter. To add, use F11.

-----Device-----  --#--  -----Control Unit Numbers + -----
/ Number Type +      PR OS 1--- 2--- 3--- 4--- 5--- 6--- 7--- 8--- Base
_ 8100   3390B        1  1  8100 _____ _____ _____ _____ _____
/ 8101   3390B        1  1  8100 _____ _____ _____ _____ _____ ← Select device.
_ 8102   3390B        1  1  8100 _____ _____ _____ _____ _____
_ 8103   3390B        1  1  8100 _____ _____ _____ _____ _____
_ 8104   3390B        1  1  8100 _____ _____ _____ _____ _____
_ 8105   3390B        1  1  8100 _____ _____ _____ _____ _____
_ 8106   3390B        1  1  8100 _____ _____ _____ _____ _____
_ 8107   3390B        1  1  8100 _____ _____ _____ _____ _____
_ 8108   3390B        1  1  8100 _____ _____ _____ _____ _____
_ 8109   3390B        1  1  8100 _____ _____ _____ _____ _____
_ 810A   3390B        1  1  8100 _____ _____ _____ _____ _____
_ 810B   3390B        1  1  8100 _____ _____ _____ _____ _____
_ 810C   3390B        1  1  8100 _____ _____ _____ _____ _____

```

2. After selecting the device, select option 8 to open the View Device Definition window (see the following example).

Example: Actions on Selected Devices

```

                Actions on selected devices

Select by number or action code and press Enter.

_8  1.  Add like . . . . . (a)  ← Select option 8.
    2.  Change . . . . . (c)
    3.  CSS group change . . . . . (g)
    4.  OS group change . . . . . (o)
    5.  Device type group change . . . . . (t)
    6.  Prime serial number and VOLSER . . (i)
    7.  Delete . . . . . (d)
    8.  View device definition . . . . . (v)
    9.  View logical CU information . . . . (l)
   10.  View related CTC connections . . . (k)
   11.  View graphically . . . . . (h)

F1=Help      F2=Split      F3=Exit      F9=Swap      F12=Cancel

```

3. Review the information on the View Device Definition window and press Enter to continue (see the following example).

Example: View Device Definition

```
View Device Definition

Device number . . . . . : 8101
Device type . . . . . : 3390B

Serial number . . . . . :
Description . . . . . : HP XP1024/XP12000 - 8101 (B)

Volume serial number . . . . : (for DASD)

Connected to CUs : 8100

ENTER to continue.          ← Press Enter to continue.

F1=Help    F2=Split    F3=Exit    F9=Swap    F12=Cancel -
```

4. Select the processor definition on the View Device / Processor Definition window (see the following example).

Example: Selecting the Processor Definition

```
View Device / Processor Definition                                Row 1 of 1

Command ==> _____ Scroll ==> CSR

Select one or more processors to view the device candidate list, or
ENTER to continue without selection.

Device number . : 8101      Device type . : 3390B

Preferred Explicit Device
/ Processor ID  UA   Time-Out STADET CHPID   Candidate List
/ SYSTEM#S     00   No       Yes          Yes ← Select processor.
***** Bottom of data *****

F1=Help    F2=Split    F3=Exit    F6=Previous  F7=Backward
F8=Forward  F9=Swap     F12=Cancel  F22=Command
```

5. Review the candidate list for this device and press Enter to continue (see the following example).

Example: View Device Candidate List

```
View Device Candidate List

Row 1 of 5
Command ==> _____ Scroll ==> CSR

The following partitions are allowed to have access to the
device.

Device number . : 8101      Device type . . . : 3390B
Processor ID . . : SYSTEM#S  Lab System - F9 - Skyline

ENTER to continue.          ← Press Enter to continue.

Partition Name  Description                      Reachable
AS04            System A / LPAR 4                 Yes
DASDPERF        DASD Performance & Testing        Yes
MVSLAB          MVS Lab System - OS/390 2.9        Yes
OS390           OS/390 Testing (ie. SYSPLEX)        Yes
VMLAB           VM Lab System - VM/ESA 1.2.0        Yes
***** Bottom of data *****

F1=Help      F2=Split      F3=Exit      F7=Backward  F8=Forward
F9=Swap      F12=Cancel   F22=Command -
```

6. From the View Device / OS Configuration Definitions window, select the OS configuration (see the following example).

Example: Selecting the OS Configuration

```
View Device / OS Configuration Definitions

Row 1 of 1
Command ==> _____ Scroll ==> CSR

Select OSs to view more details, then press Enter.

Device number . : 8101      Device type . . : 3390B

/ Config. ID  Type      Description
/ LABSYSTEM  MVS        OS Configuration List (EDT's) ← Select OS.
***** Bottom of data *****

F1=Help      F2=Split      F3=Exit      F6=Previous  F7=Backward
F8=Forward   F9=Swap      F12=Cancel   F22=Command -
```

7. The View Device Parameter / Feature Definition window displays the WLMPAV device parameters (see the following example).

Example: View Device Parameters

```
~                               View Device Parameter / Feature Definition
                               Row 1 of 6

Command ===> _____ Scroll ===> CSR

Configuration ID . : LABSYSTM      OS Configuration List (EDT's)
Device number   . . : 8100         Device type    . . . : 3390B
Generic / VM device type . . . . : 3390

ENTER to continue.

Parameter/
Feature      Value   Req.  Description
OFFLINE      No      Device considered online or offline at IPL
DYNAMIC      Yes     Device supports dynamic configuration
LOCANY       Yes     UCB can reside in 31 bit storage
WLMPAV       Yes     Device supports work load manager ← WLMPAV parameter.
SHARED       Yes     Device shared with other systems
SHAREDUP     No      Shared when system physically partitioned
***** Bottom of data *****

F1=Help      F2=Split    F3=Exit      F7=Backward  F8=Forward
F9=Swap      F12=Cancel  F22=Command -
```

Checking the WLM PAV Settings

To view or change the Workload Manager PAV settings:

1. From the WLM Initial window, press Enter to continue (see the following example).

Example: WLM Initial Window

```
Command ===> _____

                               W   W   L       M   M
                               W   W   L       MM  MM
                               W W W   L       M M M
                               WW WW   L       M   M
                               W   W   LLLLL  M   M

                               Licensed Materials - Property of IBM

                               5647-A01 (C) Copyright IBM Corp. 2000.
                               All rights reserved.

                               ENTER to continue
```

2. Use the Service Definition window to define where the service coefficient information can be found. Select option 1 to read the saved definition (see the following example).

Example: WLM Choose Service Definition Window

```
File  Help
-----
Command ==> _____

~
|          Choose Service Definition          |
|_____|
| Select one of the following options.         |
|_1 1. Read saved definition                   | ← Select option 1.
|    2. Extract definition from WLM           |
|       couple data set                       |
|    3. Create new definition                 |
|_____|
| F1=Help      F2=Split      F5=KeysHelp      |
| F9=Swap      F12=Cancel    |
|_____|
|          ENTER to continue                   |
```

3. From the Primary Options window, select option 8 to display the WLM PAV settings (see the following example).

Example: WLM Primary Options Window

```
File  Utilities  Notes  Options  Help
-----
Functionality LEVEL008      Definition Menu      WLM Appl LEVEL011
Command ==> _____

Definition data set . . . : none

Definition name . . . . . STANDARD (Required)
Description . . . . . Standard Definition

Select one of the
following options. . . . ._8 1. Policies          ← Select option 8.
                             2. Workloads
                             3. Resource Groups
                             4. Service Classes
                             5. Classification Groups
                             6. Classification Rules
                             7. Report Classes
                             8. Service Coefficients/Options
                             9. Application Environments
                             10. Scheduling Environments
```


4. Use the Service Coefficient/Service Definition Options window to set PAV Dynamic Alias Management (see the following example).

Example: WLM Service Coefficient/Service Definition Options Window

Coefficients/Options	Notes	Options	Help

-			
Service Coefficient/Service Definition Options			
Command ==>			

Enter or change the Service Coefficients:			
CPU	1.0	(0.0-99.9)
IOC	0.1	(0.0-99.9)
MSO	0.0000	(0.0000-99.9999)
SRB	1.0	(0.0-99.9)
Enter or change the service definition options:			
I/O priority management	YES	(Yes or No)
Dynamic alias management	YES	(Yes or No)

4 SANtinel - S/390 for the XP128/XP1024/XP12000

SANtinel protects data in your disk array from I/O operations performed at mainframe hosts. You can use SANtinel to apply security to logical volumes so that the specified mainframe hosts will be unable to read from and write to the specified logical volumes. You can also use SANtinel to prevent data on logical volumes from being overwritten by erroneous remote copy operations.

SANtinel can be used in conjunction with an add-in program called SANtinel Port Security Option, which provides port-level security by preventing hosts from accessing logical volumes through specified ports.

Port-level security is a security policy for enabling hosts to access logical volumes only through ports registered in host groups and thus prohibiting hosts to access the volumes through other ports.



NOTE: Logical volumes are sometimes referred to as logical devices or LDEVs. Also, this chapter sometimes uses the term LDEV security to refer to the security policy that you can apply to logical volumes.

Overview of SANtinel Operations

System Requirements

To use SANtinel, you need the following:

- XP128/XP1024/XP12000 with firmware version 21.06.22 or later installed
- Web client to access the Command View management station
- SANtinel license key installed

To apply port-level security, also install SANtinel Port Security Option. Before installing this program, SANtinel must already be installed.

Protecting Logical Volumes from I/O Operations at Mainframe Hosts

Use SANtinel to protect logical volumes from unauthorized accesses by mainframe hosts. To protect logical volumes from unauthorized accesses, you must create *security groups* and then register mainframe hosts and/or logical volumes in security groups. Security groups are classified into *access groups* or *pool groups*. If you want to allow some mainframe hosts to access logical volumes, you must classify the security group as an access group. If you want to prohibit all mainframe hosts from access logical volumes, classify the security group as a pool group.

Enabling Only the Specified Hosts to Access Logical Volumes

If you want to allow only some mainframe hosts in your network to access logical volumes, register the mainframe hosts and the logical volumes in an access group. For example, if you register two hosts (*host_A* and *host_B*) and two logical volumes (*vol_C* and *vol_D*) in an access group, only the *host_A* and *host_B* will be able to access *vol_C* and *vol_D*. No other hosts will be able to access *vol_C* and *vol_D*.

If mainframe hosts are registered in an access group, the hosts will be able to access logical volumes in the same access group, but will be unable to access other logical volumes. For example, if you register two hosts (*host_A* and *host_B*) and two logical volumes (*vol_C* and *vol_D*) in an access group, the *host_A* and *host_B* can access *vol_C* and *vol_D*, but cannot access other logical volumes.

To register hosts in an access group, create a host group, register the hosts in the host group, and then register the host group in the access group. To register logical volumes in an access group, create an LDEV group, register the logical volumes in the LDEV group, and then register the LDEV group in the access group. An access group can only contain one host group and one LDEV group.

The following figure shows six mainframe hosts attached to a disk array, and two available access groups. The following security settings have been applied:

- The logical volumes *ldev1* and *ldev2* are accessible only from *host1*, *host2*, and *host3* because the two volumes and the three hosts are registered in the same access group.
- The logical volume *ldev4* is accessible only from *host4* because *ldev4* and *host4* are registered in the same access group.
- The logical volume *ldev5* does not belong to any access groups. For this reason, hosts in access groups cannot access *ldev5*. *ldev5* is only accessible from *host5* and *host6*, which are not registered in access groups.

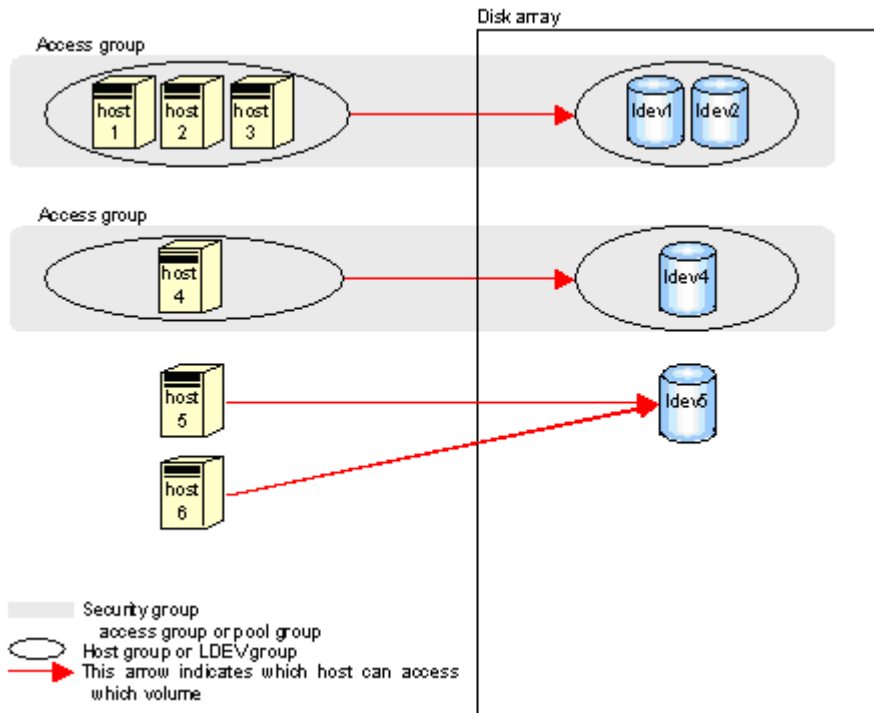


Figure 166 Security example 1

Usually, hosts are connected to two or more ports by cables and have access to logical volumes through these ports. In the previous security example, hosts in access groups can access logical volumes through every port to which the hosts are connected.

However, SANtinel Port Security Option prohibits hosts from accessing logical volumes through specified ports. For example, if a host named *host1* is connected to two ports (*port1* and *port2*), you can permit the host to access logical volumes through *port1* and prohibit the host from accessing logical volumes through *port2*. To implement port-level security, first determine which ports hosts can use to access logical volumes, and then you must register the ports in host groups. For example, if you register *host1* and *port1* in the same host group named *hg1* and then register *hg1* in an access group, *host1* can access logical volume through *port1* but cannot access logical volumes through *port2*.

In security example 2, the following security settings have been applied:

- The hosts *host1*, *host2*, and *host3* can access the logical volumes *ldev1* and *ldev2* through *port1*, *port2*, and *port3*. However, the hosts cannot access the logical volumes through other ports.
- The host *host4* can access the logical volume *ldev4* through *port4*. However, the host cannot access the logical volume through other ports.

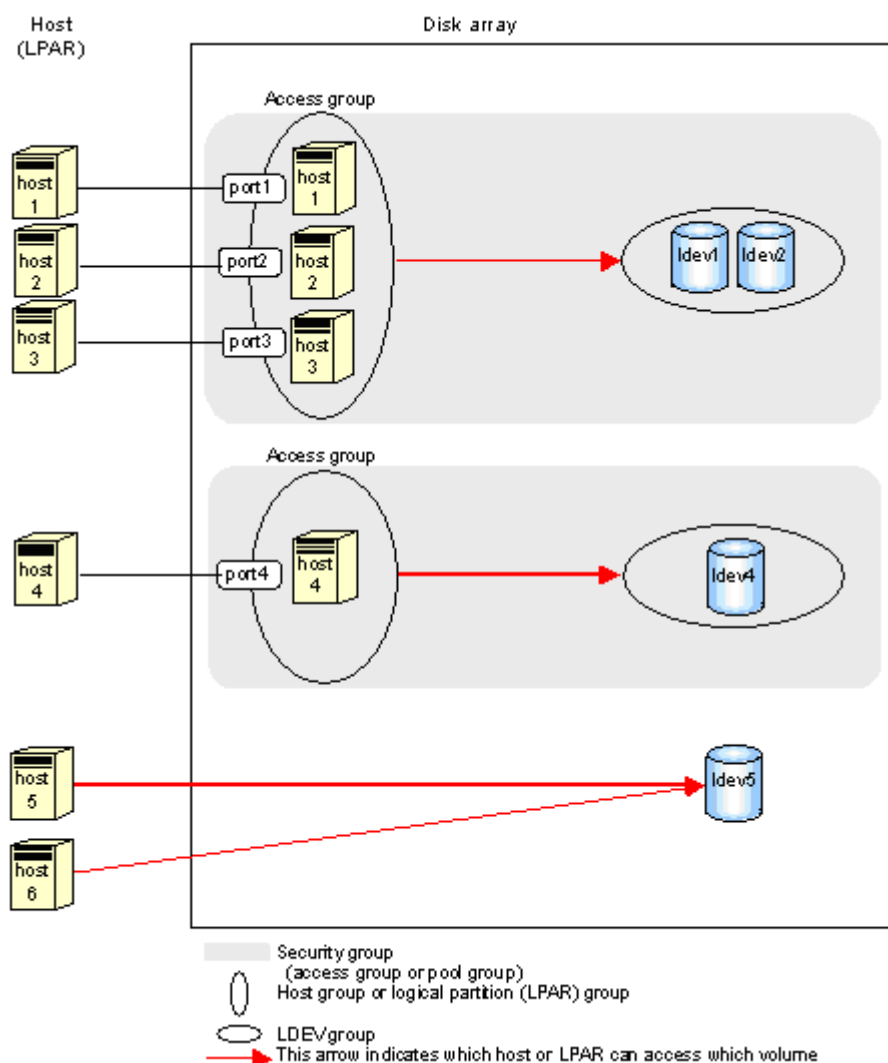


Figure 167 Security example 2

If no ports are registered in a host group, hosts in the host group can access logical volumes through the ports to which the hosts are connected.

Before you apply security, confirm which hosts are performing I/O operations on logical volumes in access groups. If any hosts perform I/O operations on logical volumes in access groups that the hosts do not belong to, stop the I/O operations before applying security. For example, if you attempt to apply security settings illustrated in the previous figure, an error occurs and the attempt fails if *host4* and *host5* are performing I/O operations on *ldev1*. To apply the security settings, first ensure that *host4* and *host5* are not performing I/O operations on *ldev1*.

Prohibiting All Hosts from Accessing Logical Volumes

To prevent all the mainframe hosts from accessing logical volumes, register the logical volumes in a *pool group*. You do not need to register hosts in pool groups. For example, if you register two logical volumes (*vol_A* and *vol_B*) in a pool group, all the mainframe hosts connected to your disk array will be unable to access *vol_A* and *vol_B*. To register logical volumes in a pool group, create an LDEV group, register the

logical volumes in the LDEV group, and then register the LDEV group in the pool group. A pool group can only contain one LDEV group.

The following figure shows an example of a pool group. The logical volumes in this pool group are not accessible from all the hosts.

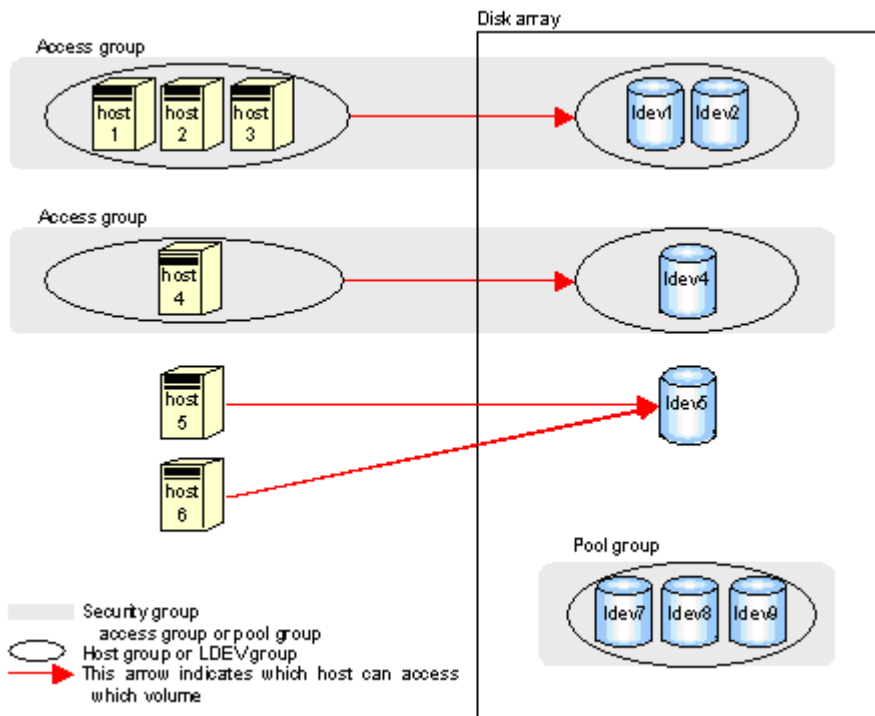


Figure 168 Security example 3

Protecting Logical Volumes from Erroneous Remote Copy Operations

If you use TrueCopy (TC390) or ShadowImage (SI390) to perform remote copy operations, data will be overwritten onto the secondary volumes. If a volume containing important data is specified as a secondary volume by mistake, TC390 or SI390 remote copy operations can overwrite important data on the volume and you could suffer loss of important data. SANtinel prevents this type of data loss. If a volume contains data that should not be overwritten, you can prevent the volume from being used as a secondary volume.



NOTE: Secondary volumes are often referred to as remote volumes or R-VOLs in the TC390 chapter. Also, secondary volumes are referred to as target volumes or T-VOLs in the SI390 chapter.

Restrictions and Cautions

Do not apply security to logical volumes on which any job is running. If you apply security to such a volume, the job will possibly end abnormally.

When applying security, please make sure that your security settings are correct. If incorrect security settings are made, the system will be difficult or impossible to control.

If the CPU of a mainframe host is upgraded after you apply security settings, execute the system command "D M=CPU" at the mainframe host to obtain the latest information about the host. Next, use the latest information to update host information in the Add/Change Host window. If you do not update host information, the system will be impossible to control.

Volume emulation types (or device emulation types)

SANtinel supports the following volume emulation types: 3990-3, 3390-3A, 3390-3B, 3390-3C, 3390-3R, 3390-9, 3390-9A, 3390-9B, 3390-9C, 3390-L, 3390-LA, 3390-LB, and 3390-LC.

PCB types

SANtinel supports the following PCB types:

- ESCON or ACONARC
- FICON or FIBARC

Maximum possible number of security groups, host groups, and LDEV groups

SANtinel can manipulate up to 32 hosts and 8,192 logical volumes for one disk array. SANtinel can create up to 32 security groups, 32 host groups, and 32 LDEV groups for one disk array.

Security groups are classified into access groups and pool groups:

- An access group can contain only one host group and one LDEV group. A host group can contain up to 16 hosts. An LDEV group can contain up to 8,192 logical volumes.
- A pool group can contain only one LDEV group. An LDEV group can contain up to 8,192 logical volumes.

TrueCopy (TC390) or ShadowImage (SI390) users

When you use SANtinel to make security settings, be sure to register the primary volume and the secondary volume (such as, the copy source volume and the copy destination volume) in the same LDEV group. For information on how to register volumes in LDEV groups, refer to ["Registering Logical Volumes in an LDEV Group"](#) on page 398.

If you apply security to a primary volume of a TC390 pair or an SI390 pair, some or all mainframe hosts might be unable to read from and write to the primary volume. However, the remote copy operation will perform normally; data will copy from the primary volume to the secondary volume.

If you register a primary volume or secondary volume in a security group and then make a setting to prevent the volume from being used as a secondary volume, this setting will take effect after the pair is split.

Mainframe hosts cannot access logical volumes in pool groups. If a logical volume in a pool group is specified as a primary volume, the pair creation command might fail.

In the TC390 chapter, primary volumes are often referred to as M-VOLs or main volumes. Also, secondary volumes are often referred to as R-VOLs or remote volumes. In the SI390 chapter, primary volumes are often referred to as S-VOLs or source volumes. Also, secondary volumes are often referred to as T-VOLs or target volumes.

VSC volumes

If you apply security to a VSC volume, you will be unable to change the VSC settings on the volume. To change the VSC settings, use SANtinel to disable security on the VSC volume. For details on how to disable security, refer to ["Disabling Security"](#) on page 404.

HPAV users

If you apply security to an HPAV base volume, the security settings will also apply to the corresponding alias volume.

Removing secured logical volumes


If you apply security to a logical volume, you will be unable to remove the volume. To remove the volume, disable security on the volume. For details on how to disable security, refer to ["Disabling Security"](#) on page 404.

Removing PCBs with secured ports

If port-level security is applied to your disk array, you cannot remove the PCBs (printed circuit boards) that include secured ports. To remove PCBs that include secured ports, use SANtinel Port Security Option to disable security on the ports. For details on how to disable security, refer to “[Deleting Ports from Host Groups](#)” on page 409.

Starting SANtinel

To access SANtinel:

1. From the Launch window, click an XP128, XP1024, or XP12000.
2. Click the **Mainframe** tab, click the **Mainframe Connection** button (), and then click the **SANtinel** tab. The SANtinel window is displayed.

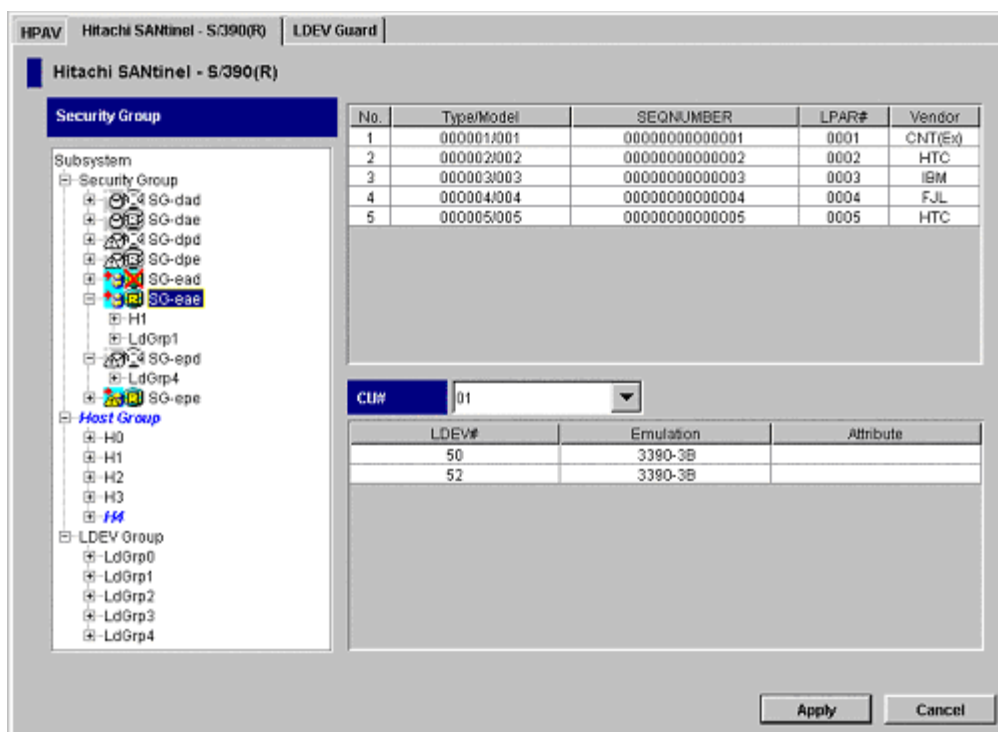


Figure 169 SANtinel window

SANtinel Window

The SANtinel window is the starting point for all the SANtinel operations.









Security Group tree

The Security Group tree is located on the left side of the window and displays a view a list of security groups, host groups, and LDEV groups. The tree contains the following folders:

- **Security Group:** Contains all of the security groups. Double-clicking a security group displays the host group and/or LDEV group registered in the security group.

The security group icons show the security settings applied to the logical volumes.

Table 118 Security group icons for SANtinel operations

Icon	Status
	Logical volumes in this access group can be used as secondary volumes for remote copy operations.
	Logical volumes in this access group cannot be used as secondary volumes for remote copy operations.
	Logical volumes in this pool group can be used as secondary volumes for remote copy operations.
	Logical volumes in this pool group cannot be used as secondary volumes for remote copy operations.
	The security settings in this security group are currently disabled. If you enable the security settings, this security group will be classified as an access group. Also, logical volumes in this security group can be used as secondary volumes for remote copy operations.
	The security settings in this security group are currently disabled. If you enable the security settings, this security group will be classified as an access group. Also, logical volumes in this security group will be unavailable for use as secondary volumes for remote copy operations.
	The security settings in this security group are currently disabled. If you enable the security settings, this security group will be classified as a pool group. Also, logical volumes in this security group will be available for use as secondary volumes for remote copy operations.
	The security settings in this security group are currently disabled. If you enable the security settings, this security group will be classified as a pool group. Also, logical volumes in this security group will be unavailable for use as secondary volumes for remote copy operations.

- **Host Group:** Contains all of the host groups.
- **LDEV Group:** Contains all of the LDEV groups.

Changes made to the groups in the Security Group tree are displayed in italics and in blue. The text will be restored to the original typeface and color when changes are applied or canceled.

Hosts table

The Hosts table is located in the upper-right area of the window and displays information about the hosts. The table contents depends the item selected in the Security Group tree.

- Click one of the group folders (Security Group, Host Group, or LDEV Group) to display all the hosts.
- Click a security group to display all the hosts that belong to the selected security group.
- Click a host group to display all the hosts that belong to the selected host group.
- Clicking an LDEV group displays nothing.

The table columns provide the following information:

- **Type/Model:** The type and the model number of a host or a channel extender.
- **SEQNUMBER:** The node ID of a host or a channel extender.

- **LPAR#:** A logical partition number of a host.
- **Vendor:** The vendor of the host. For instance, this column can display **FJT** (Fujitsu), **IBM**, **HTC** (Hitachi), and **CNT(Ex)**. If **CNT(Ex)** is displayed, the table row indicates the type, the model number, and the node ID of a channel extender.

Changes made to a host are displayed in italics and in blue. The text will be restored to the original typeface and color when changes are applied or canceled.

LDEVs table

The LDEVs table is located in the lower-right area of the window and displays information about the logical volumes.

- **CU#:** Use this list to select a logical CU, which displays the logical volumes in the selected CU.

The table contents depends on the item selected in the Security Group tree.

- Click one of the group folders (Security Group, Host Group, or LDEV Group) to display all the logical volumes that are accessible from the mainframe hosts.
- Click a security group to display all the logical volumes that belong to the selected security group.
- Click an LDEV group to display all the logical volumes that belong to the selected LDEV group.
- Clicking a host group displays nothing.

The table columns provide the following information:

- **LDEV#:** The logical volume ID. This ID is a hexadecimal number (00 to FF).
- **Emulation:** The emulation type of the logical volume.
- **Attribute:** The status of the logical volume. If an asterisk (*) is displayed, the logical volume is specified as a secondary volume (copy destination) for TC390 or SI390. If a plus symbol (+) is displayed, one or more LU paths are assigned to the logical volume.

Changes made to a logical volume are displayed in italics and in blue. The text will be restored to the original typeface and color when changes are applied or canceled.

Buttons

- **Apply button:** Applies the settings made on this window to the disk array.
- **Cancel button:** Discards changes and restores the initial settings.

Applying and Disabling Security

This section contains the following topics about applying security settings:

- Enabling specific hosts to access certain logical volumes (see page 395)
- Prohibiting all hosts from accessing logical volumes (see page 401)
- Preventing data in logical volumes from being overwritten by remote copy operations (see page 403)
- Disabling security (see page 404)

You must operate Command View in Modify mode to perform SANtinel operations. Users in view mode can only view SANtinel information.

Enabling Only the Specified Hosts to Access Logical Volumes

Take the following steps to allow specific hosts to access certain logical volumes so that the other hosts cannot access the volumes:

- Create a host group (see page 395)
- Register hosts in the host group (see page 396)
- Register ports in the host group (see page 397)
- Create an LDEV group (see page 398)
- Register logical volumes in an LDEV group (see page 398)
- Create a security group and classify it as an access group (see page 399)
- Register a host group and an LDEV group in the security group (see page 400)

Creating a Host Group

To specify which hosts can access certain volumes, first create a host group.

To create a host group:

1. From the SANtinel window, right-click **Host Group**. A pop-up menu is displayed.
2. Click **Add/Change** from the pop-up menu. The Add/Change Host Group window is displayed.

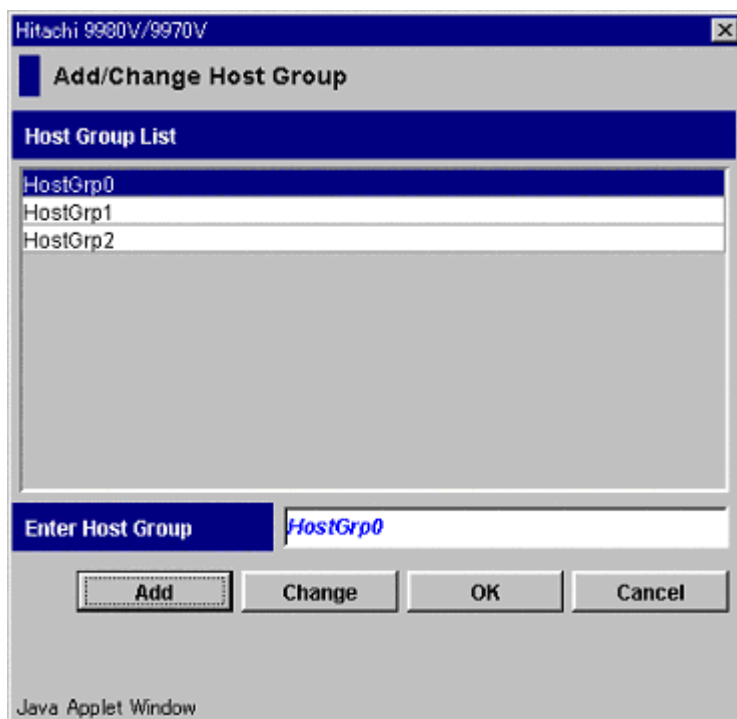


Figure 170 Add/Change Host Group window

3. In the **Enter Host Group** box, enter the name of the host group that you want to create, and then click **Add**.

Host group names can be up to eight characters and are case-sensitive. The first character and the last character must not be a space. Also, the following characters are unusable in host group names:
\\ , / : ; * ? " < > |





4. Confirm that the new host group is shown in blue in Host Group List, and then click **OK**.
5. From the SANtinel window, click **Apply**. A confirmation dialog box is displayed.

- Click **Yes**. The settings are applied to the disk array.

Registering Hosts in a Host Group

After creating a host group, register hosts in a host group by using the Add/Change Host window. The Add/Change Host window contains a table that lists the hosts. The following icons are used in the table:

Table 119 Add/Change Host window icons

Icon	Status
	The host is registered in the current host group and is attached to the disk array by a cable.
	The host is registered in the current host group and is not attached to the disk array.
	The host is registered in another host group (though the host can be registered in the current host group) and is attached to the disk array by a cable.
	The host is registered in another host group (though the host can be registered in the current host group), but it is not attached to the disk array.
No icon	The host is not registered in any host group, but it is attached to the disk array by a cable.

To register hosts in a host group:

- From the SANtinel window, right-click a host group. A pop-up menu is displayed.
- Click **Specify** and then **Host** from the pop-up menu. The Add/Change Host window displays a list of hosts.

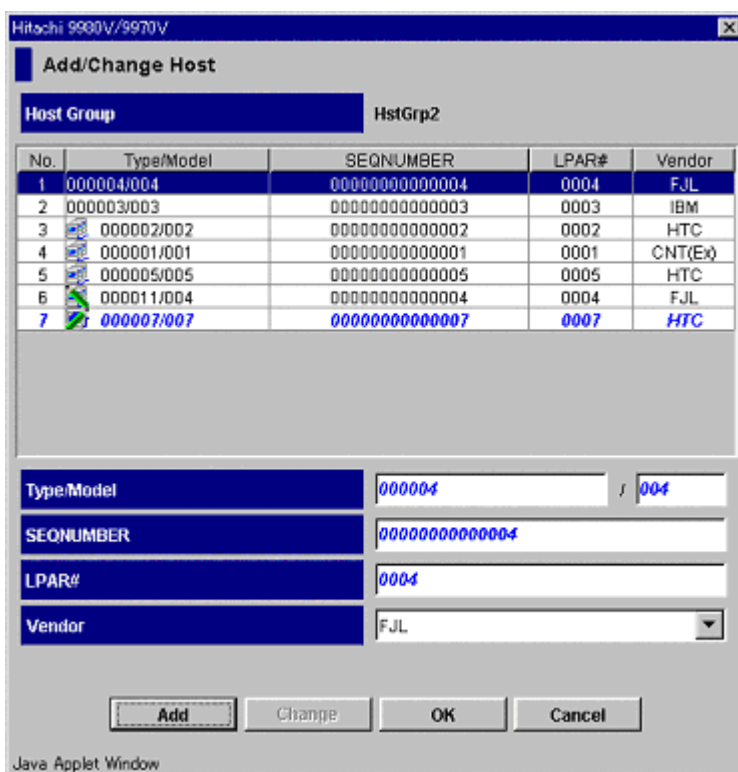






Figure 171 Add/Change Host window

- Select and then right-click one or more hosts that you want to register.

The  or  icon indicates that the host is already registered in the specified host group. You cannot register hosts that belong to any other host group. If no ports are registered in the displayed host group, you can register the following hosts:

- Hosts that do not belong to any host group.
 - Hosts belonging to host groups in which no ports are registered. You cannot register hosts belonging to host groups in which ports are registered.
4. Click **Registration** and then **Register Host in Host Group** from the pop-up menu. The specified hosts are shown in blue and are represented with the  or  icon.
 5. Click **OK**.
 6. From the SANtinel window, click **Apply**. A confirmation dialog box is displayed.
 7. Click **Yes**. The settings are applied to the disk array.

Registering Ports in a Host Group

After registering hosts in a host group, you can register ports in the host group to implement port-level security. This is an optional step, but to do this, you must have SANtinel Port Security Option installed.

If you do not want to implement port-level security, you do not need to register ports in host groups. If no ports are registered in a host group, hosts in the host group can access logical volumes through every port to which the hosts are connected.

To register ports in a host group:

1. From the SANtinel window, right-click a host group. A pop-up menu is displayed.
2. Click **Specify** and then **Port** from the pop-up menu. The Select Port window displays a list of ports.

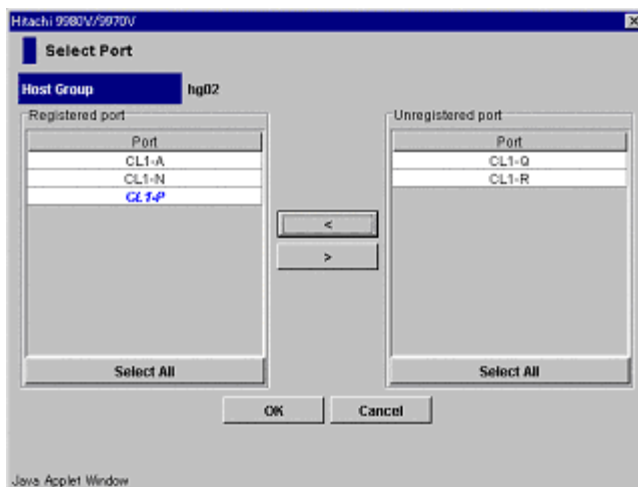


Figure 172 Select Port window

3. From the Unregistered port list, click the ports you want to register and then click the < button to move them to the Registered port list. The specified ports should be shown in blue in the Registered port list. To select all the ports in the Unregistered port list, click **Select All**.



NOTE: If hosts registered in the host group are also registered in another host group, you cannot register the ports in Registered port list, and thus you cannot implement port-level security.

4. Click **OK**.
5. From the SANtinel window, click **Apply**. A confirmation dialog box is displayed.
6. Click **Yes**. The settings are applied to the disk array.

Creating an LDEV Group

To specify logical volumes that should be secured, create an LDEV group and then register the logical volumes in the LDEV group.

To create an LDEV group:

1. From the SANtinel window, right-click **LDEV Group**. A pop-up menu is displayed.
2. Click **Add/Change** from the pop-up menu. The Add/Change LDEV Group window is displayed.



Figure 173 Add/Change LDEV Group window

3. In the **Enter LDEV Group** box, enter the name of the LDEV group that you want to create, and then click **Add**.

LDEV group names can be up to eight characters and are case-sensitive. The first character and the last character must not be a space. Also, the following characters are unusable in host group names:
\\ , / : ; * ? " < > |
4. Confirm that the new LDEV group is shown in blue in LDEV Group List, and then click **OK**.
5. From the SANtinel window, click **Apply**. A confirmation dialog box is displayed.
6. Click **Yes**. The settings are applied to the disk array.

Registering Logical Volumes in an LDEV Group

After creating an LDEV group, register the logical volumes in an LDEV group.

To register logical volumes in an LDEV group:

1. From the SANtinel window, right-click **LDEV Group**. A pop-up menu is displayed.

2. Click **Specify** and then **LDEV** from the pop-up menu. The Select LDEV window is displayed.

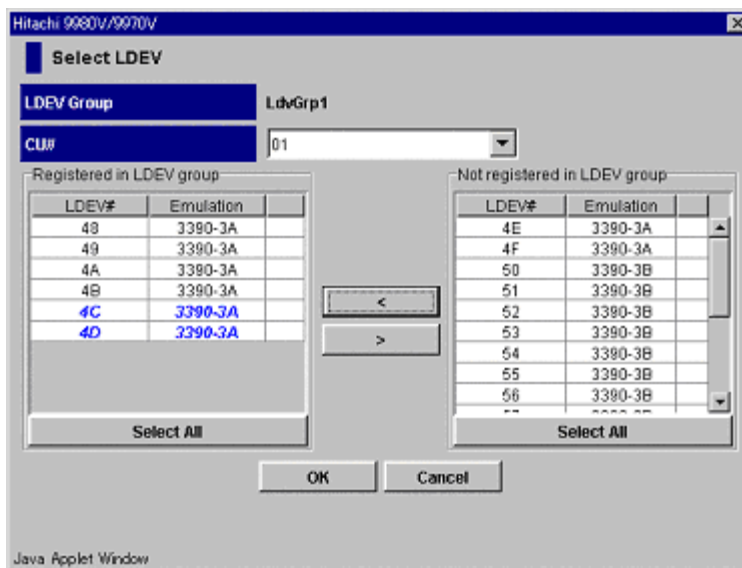


Figure 174 Select LDEV window

3. In the **CU#** list, click a CU image. The tables located below the list display the logical volumes in the CU image you selected. The Registered in LDEV group table displays the logical volumes registered in the LDEV group. The Not registered in LDEV group table displays logical volumes that are not registered in the LDEV group.
4. In the Not registered in LDEV group table, click the logical volumes that you want to register. Then, click the < button to move the selected logical volumes move to the Registered in LDEV group table.
5. To register logical volumes in other CU images, repeat the previous steps.
6. Click **OK**.
7. From the SANtinel window, click **Apply**. A confirmation dialog box is displayed.
8. Click **Yes**. The settings are applied to the disk array.

Creating a Security Group for Use As an Access Group

To make security settings, you must create security groups. You can classify security groups as access groups or pool groups. To allow logical volumes to be accessed only by specified hosts, classify a security group as an *access group*.

To create a security group and classify the group as an access group:

1. From the SANtinel window, right-click **Security Group**. A pop-up menu is displayed.

2. Click **Add/Change** from the pop-up menu. The Add/Change Security Group window is displayed.

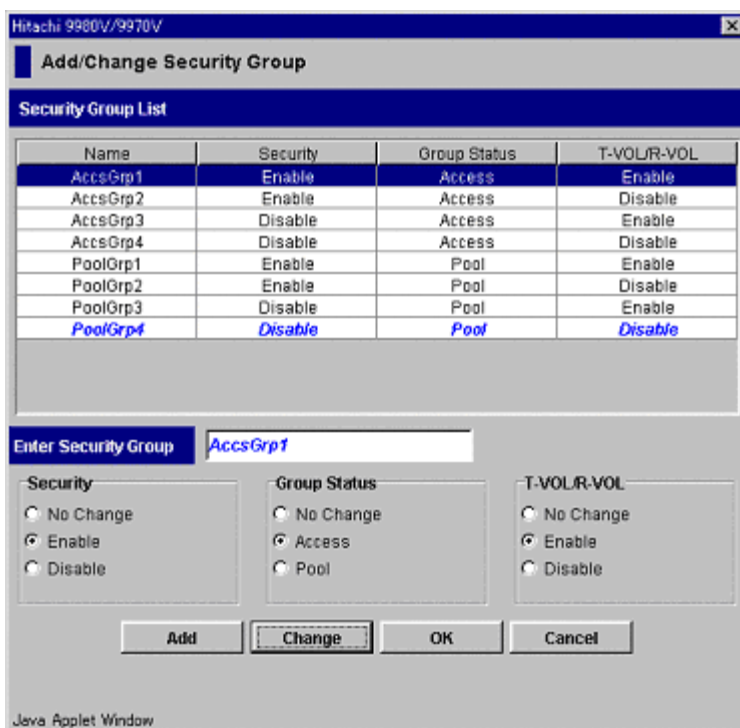


Figure 175 Add/Change Security Group window

3. In the **Enter Security Group** box, enter the name of the security group that you want to create.
Security group names can be up to eight characters and are case-sensitive. The first character and the last character must not be a space. Also, the following characters are unusable in security group names: \ , / : ; * ? " < > |
4. Under Security, click **Enable**.
5. Under Group Status, click **Access**.
6. Under T-VOL/R-VOL, click **Enable** or **Disable**. Click **Enable** to allow logical volumes in the security group to be used as secondary volumes for remote copy operations. Click **Disable** to prohibit this.
7. Click **Add**. Information about the new security group is added to the Security Group List and is shown in blue.
8. Click **OK**.
9. From the SANtinel window, click **Apply**. A confirmation dialog box is displayed.
10. Click **Yes**. The settings are applied to the disk array.

Registering a Host Group and an LDEV Group in a Security Group

After classifying your security group as an access group, register your host group and LDEV group into the security group. When you complete this, the logical volumes in the LDEV group are secured and can only be accessed by hosts in the host group. Other hosts cannot access the logical volumes.

To register a host group and an LDEV group into a security group:

1. From the SANtinel window, right-click a host group. A pop-up menu is displayed.

2. Click **Specify** and then **Security Group** from the pop-up menu. The Specify Security Group window is displayed.

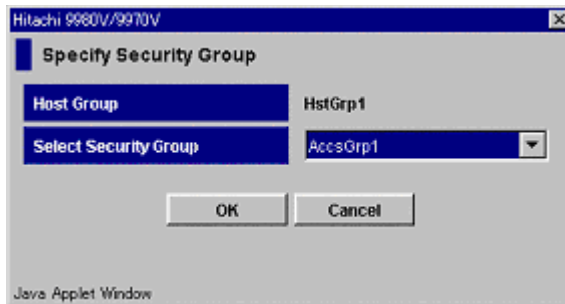


Figure 176 Specify Security Group window

3. In the **Select Security Group** list, click a security group and then click **OK**.
4. From the SANtinel window, right-click an LDEV group. A pop-up menu is displayed.
5. Click **Specify** and then **Security Group** from the pop-up menu. The Specify Security Group window is displayed.
6. In the **Select Security Group** list, click the security group and then click **OK**.
7. From the SANtinel window, click **Apply**. A confirmation dialog box is displayed.
8. Click **Yes**. The settings are applied to the disk array.

Prohibiting All Hosts from Accessing Logical Volumes

To prohibit all the hosts from accessing the specified logical volumes, complete the following steps:

- Create an LDEV group (see page 398)
- Register logical volumes in the LDEV group (see page 398)
- Create a security group and classify it as a pool group (see page 401)
- Register the LDEV group in the security group (see page 402)

Creating a Security Group for Use As a Pool Group

To make security settings, you must create security groups. You can classify security groups as access groups or pool groups. To prohibit all hosts from accessing logical volumes, classify a security group as a *pool group*. Complete this step after creating an LDEV group and registering logical volumes in the LDEV group.

To create a security group and classify the group as a pool group:

1. From the SANtinel window, right-click **Security Group**. A pop-up menu is displayed.

2. Click **Add/Change** from the pop-up menu. The Add/Change Security Group window is displayed.

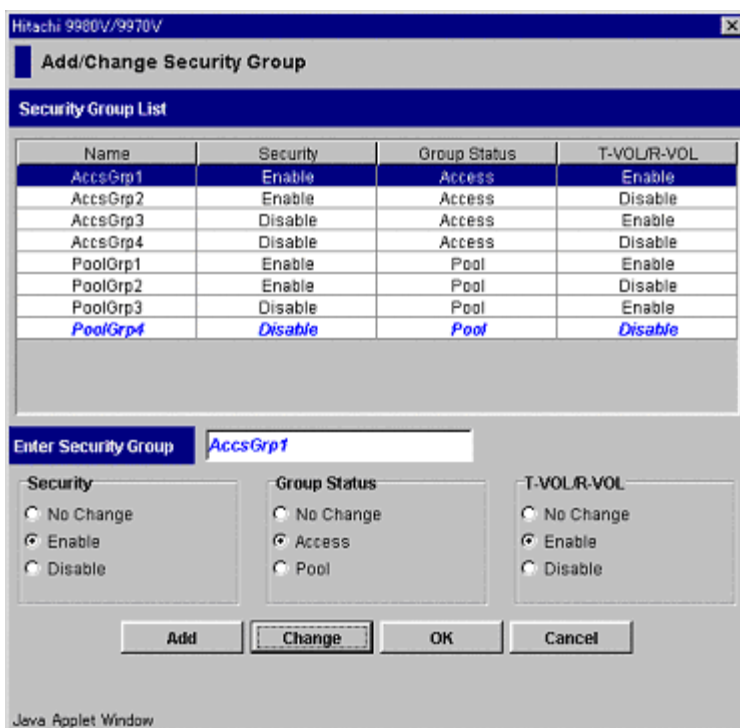


Figure 177 Add/Change Security Group window

3. In the **Enter Security Group** box, enter the name of the security group that you want to create.
Security group names can be up to eight characters and are case-sensitive. The first character and the last character must not be a space. Also, the following characters are unusable in security group names: \ , / : ; * ? " < > |
4. Under **Security**, click **Enable**.
5. Under **Group Status**, click **Pool**.
6. Under **T-VOL/R-VOL**, click **Enable** or **Disable**. Click **Enable** to allow logical volumes in the security group to be used as secondary volumes for remote copy operations. Click **Disable** to prohibit this.
7. Click **Add**. Information about the new security group is added to the Security Group List and is shown in blue.
8. Click **OK**.
9. From the SANtinel window, click **Apply**. A confirmation dialog box is displayed.
10. Click **Yes**. The settings are applied to the disk array.

Registering an LDEV Group in a Security Group

After classifying your security group as a pool group, register your LDEV group into the security group. When you complete this, the logical volumes in the LDEV group are secured and inaccessible from any hosts.

To register an LDEV group into a security group:

1. From the SANtinel window, right-click an LDEV group. A pop-up menu is displayed.

2. Click **Specify** and then **Security Group** from the pop-up menu. The Specify Security Group window is displayed.

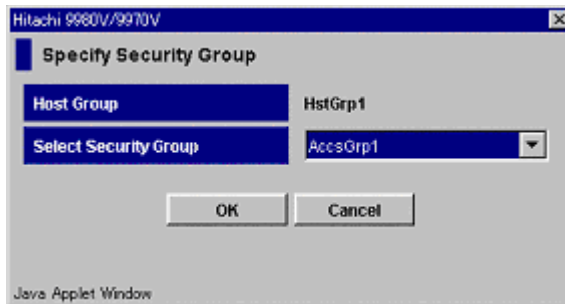


Figure 178 Specify Security Group window

3. In the **Select Security Group** list, click a security group and then click **OK**.
4. From the SANtinel window, click **Apply**. A confirmation dialog box is displayed.
5. Click **Yes**. The settings are applied to the disk array.

Protecting Logical Volumes from Remote Copy Operations

The following procedure makes logical volumes in a security group unusable as secondary volumes for remote copy operations and protects data the logical volumes from being overwritten by remote copy operations.

To make logical volumes in a security group unusable as secondary volumes:

1. From the SANtinel window, right-click **Security Group** or any specific security group. A pop-up menu is displayed.
2. Click **Add/Change** from the pop-up menu. The Add/Change Security Group window is displayed.

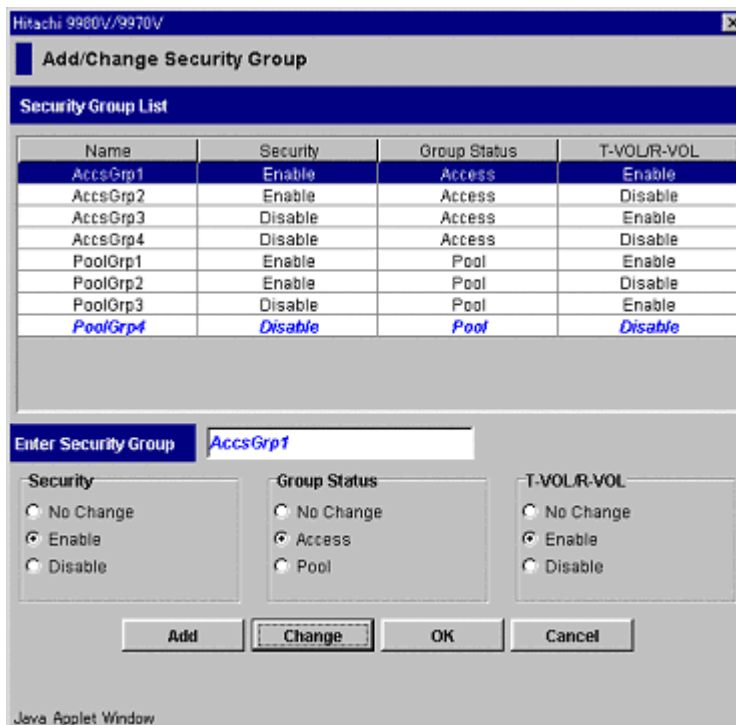


Figure 179 Add/Change Security Group window

3. In the Security Group List, click the security group you want to change.
4. Under T-VOL/R-VOL, click **Disable**.

5. Click **Change**. The change is reflected in the window.
6. Click **OK**.
7. From the SANTinel window, click **Apply**. A confirmation dialog box is displayed.
8. Click **Yes**. The settings are applied to the disk array.



NOTE: If you want to make logical volumes in your security group usable as secondary volumes for remote copy operations, click the security group in the Add/Change Security Group window and then click **Enable** under T-VOL/R-VOL. Next, click **Change** and then **OK**. Finally, click **Apply** in the SANTinel window.

Disabling Security

Complete the following procedure to disable security on logical volumes in the security group. If security is disabled, logical volumes in the security group are accessible from all hosts and are usable as secondary volumes for remote copy operations, regardless of whether the security group is an access or pool group.

If you are certain that you will not need to restore security, you can delete your security group to disable security. For details on how to delete security groups, refer to ["Deleting Security Groups"](#) on page 406.

To disable security on logical volumes:

1. From the SANTinel window, right-click the security group in which the logical volumes are registered. A pop-up menu is displayed.
2. Click **Add/Change** from the pop-up menu. The Add/Change Security Group window is displayed.

Hitachi 9980V/9970V

Add/Change Security Group

Security Group List

Name	Security	Group Status	T-VOL/R-VOL
AccsGrp1	Enable	Access	Enable
AccsGrp2	Enable	Access	Disable
AccsGrp3	Disable	Access	Enable
AccsGrp4	Disable	Access	Disable
PoolGrp1	Enable	Pool	Enable
PoolGrp2	Enable	Pool	Disable
PoolGrp3	Disable	Pool	Enable
PoolGrp4	Disable	Pool	Disable

Enter Security Group

Security

☐ No Change

☒ Enable

☐ Disable

Group Status

☐ No Change

☒ Access

☐ Pool

T-VOL/R-VOL

☐ No Change

☒ Enable

☐ Disable

Java Applet Window

Figure 180 Add/Change Security Group window

3. In the Security Group List, click the security group you want to disable.
4. Under Security, click **Disable**.
5. Click **Change**. The change is reflected in the window.

6. Click **OK**.
7. From the SANtinel window, click **Apply**. A confirmation dialog box is displayed.
8. Click **Yes**. The settings are applied to the disk array.



NOTE: If you want to restore security, click the security group in the Add/Change Security Group window and then click **Enable** under Security. Next, click **Change** and then **OK**. Finally, click **Apply** in the SANtinel window.

Editing Security Settings

Editing Security Groups

This section contains the following topics about editing security groups:

- Unregistering a host group from a security group (see page 405)
- Unregistering an LDEV group from a security group (see page 405)
- Renaming a security group (see page 406)
- Deleting a security group (see page 406)

You must operate Command View in Modify mode to perform SANtinel operations. Users in view mode can only view SANtinel information.

Unregistering a Host Group from a Security Group

To unregister a host group from a security group:

1. From the SANtinel window, double-click a security group containing the host group. The tree view displays the host group in the specified security group.
2. Right-click the host group and click **Delete** from the pop-up menu. A confirmation dialog box is displayed.
3. Click **Yes**.
4. Click **Apply**. A confirmation dialog box is displayed.
5. Click **Yes**. The settings are applied to the disk array.

Unregistering an LDEV Group from a Security Group

To unregister the LDEV group from a security group:

1. From the SANtinel window, double-click a security group containing the LDEV group. The tree view displays the LDEV group in the specified security group.
2. Right-click the LDEV group and click **Delete** from the pop-up menu. A confirmation dialog box is displayed.
3. Click **Yes**.
4. Click **Apply**. A confirmation dialog box is displayed.
5. Click **Yes**. The settings are applied to the disk array.

Renaming Security Groups

To rename a security group:

1. From the SANtinel window, right-click **Security Group** or a security group. A pop-up menu is displayed.
2. Click **Add/Change** from the pop-up menu. The Add/Change Security Group window is displayed.



Figure 181 Add/Change Security Group window

3. In the Security Group List, click the security group you want to rename.
4. In the **Enter Security Group** box, enter the new name for the security group.
Security group names can be up to eight characters and are case-sensitive. The first character and the last character must not be a space. Also, the following characters are unusable in security group names: \ , / : ; * ? " < > |
5. Click **Change**. The change is reflected in the window.
6. Click **OK**.
7. From the SANtinel window, click **Apply**. A confirmation dialog box is displayed.
8. Click **Yes**. The settings are applied to the disk array.

Deleting Security Groups

To delete a security group:

1. From the SANtinel window, right-click the security group you want to delete. A pop-up menu is displayed.
2. Click **Delete** from the pop-up menu. A confirmation dialog box is displayed.
3. Click **Yes**.
4. Click **Apply**. A confirmation dialog box is displayed.
5. Click **Yes**. The settings are applied to the disk array.

Editing Host Groups

This section contains the following topics about editing host groups:

- Registering hosts (not attached to the disk array) into a host group (see page 407)
- Deleting hosts from a host group (see page 408)
- Deleting ports from a host group (see page 409)
- Renaming a host group (see page 410)
- Deleting a host group (see page 411)

You must operate Command View in Modify mode to perform SANtinel operations. Users in view mode can only view SANtinel information.

Registering Hosts to be Attached to the Disk Array

If your organization is planning to attach new mainframe hosts to the disk array, you will possibly need to revise the security settings on logical volumes. For example, if you do not want to allow the new hosts to access some logical volumes, you might need to register the new hosts in the host group in an existing access group. You can use SANtinel to register new hosts in host groups before the new hosts are attached to the disk array.

To register a mainframe host to be attached into a host group:

1. Execute the following system command at the mainframe host:

```
D M=CPU
```

Typing this command displays the type, the model number, the node ID, and the logical partition number of the host. Write down the information to refer to it later.

1. From the SANtinel window, right-click a host group in **Host Group**. A pop-up menu is displayed.

- Click **Specify** and then **Host** from the pop-up menu. The Add/Change Host window displays a list of hosts.

Hitachi 9900V/9970V

Add/Change Host

Host Group: HstGrp2

No.	Type/Model	SEQNUMBER	LPAR#	Vendor
1	000004/004	000000000000004	0004	FJL
2	000003/003	000000000000003	0003	IBM
3	000002/002	000000000000002	0002	HTC
4	000001/001	000000000000001	0001	CNT(Ex)
5	000005/005	000000000000005	0005	HTC
6	000011/004	000000000000004	0004	FJL
7	000007/007	000000000000007	0007	HTC

Type/Model: 000004 / 004

SEQNUMBER: 000000000000004


LPAR#: 0004

Vendor: FJL



Add Change OK Cancel

Java Applet Window

Figure 182 Add/Change Host window

- Use the text boxes and the list to specify the information provided in [step 1](#).
- Click **Add**. The specified host is added to the table and is represented by the  icon.
- Click **OK**.
- From the SANtinel window, click **Apply**. A confirmation dialog box is displayed.
- Click **Yes**. The settings are applied to the disk array.

Tips

- If you registered a host in an incorrect host group, first follow the previous procedure to register the host in the correct host group. Then, follow the procedure in ["Deleting Hosts from Host Groups"](#) on page 408 to remove the host from the incorrect host group.
- To modify information about hosts with the  icon, use the Add/Change Host window. Click the host in the table and then use the text boxes and/or list to change the information. Next, click **Change** and then **OK**. Finally, click **Apply** in the SANtinel window.
- To delete a host with the  icon from the Add/Change Host window, select and right-click the host, click **Delete** from the pop-up menu, and then click **OK**. Finally, click **Apply** in the SANtinel window.

Deleting Hosts from Host Groups

To delete hosts from a host group:

- From the SANtinel window, right-click a host group. A pop-up menu is displayed.

2. Click **Specify** and then **Host** from the pop-up menu. The Add/Change Host window displays a list of hosts.

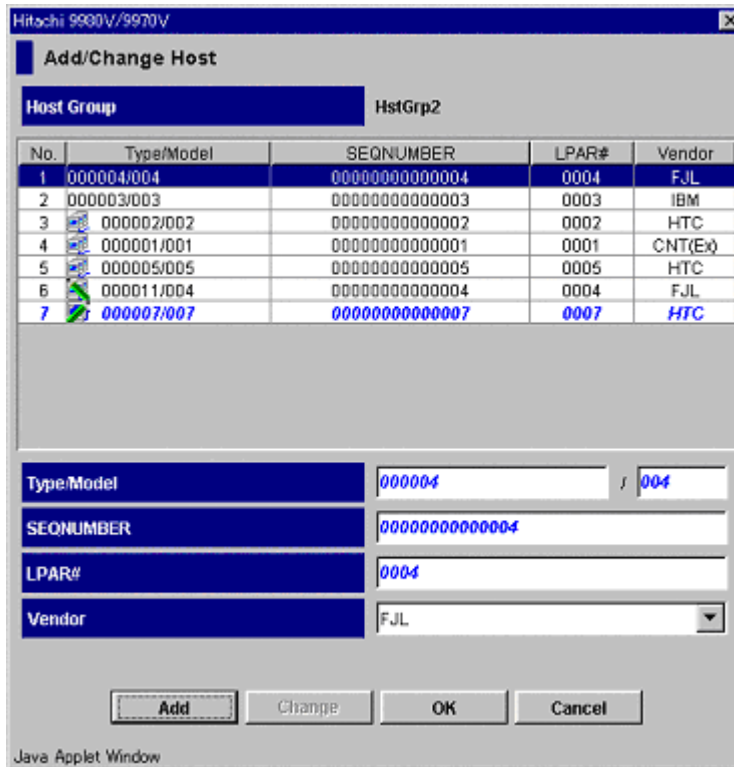








Figure 183 Add/Change Host window

3. Select and then right-click one or more hosts (with the  or  icon) that you want to delete.
4. Click **Registration** and then **Unregister Host in Host Group** from the pop-up menu. The specified hosts are shown in blue. Also, the icons are no longer displayed or will change to the  or  icon. The  and  icons indicate that the host is registered in another host group.
5. Click **OK**.
6. From the SANtinel window, click **Apply**. A confirmation dialog box is displayed.
7. Click **Yes**. The settings are applied to the disk array.

Deleting Ports from Host Groups

To delete ports from host groups, you must have SANtinel Port Security Option installed.

To delete ports from a host group:

1. From the SANtinel window, right-click a host group. A pop-up menu is displayed.

2. Click **Specify** and then **Port** from the pop-up menu. The Select Port window is displayed.

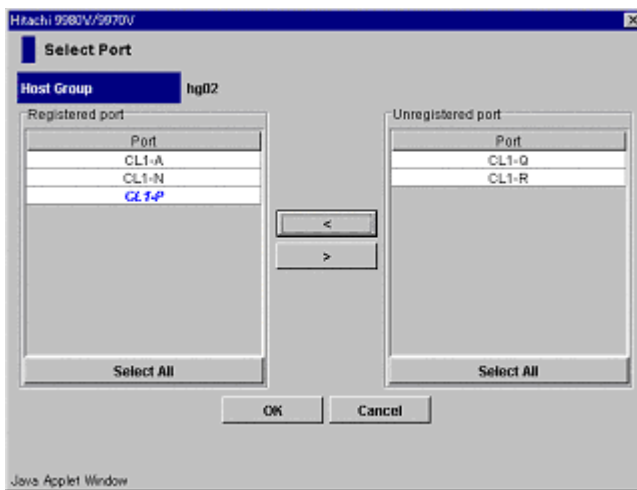


Figure 184 Select Port window

3. From the Registered port list, click the ports you want to delete and then click the > button to move them to the Unregistered port list. The specified ports should be shown in blue in the Unregistered port list. To select all the ports in the Registered port list, click **Select All**.
4. Click **OK**.
5. From the SANtinel window, click **Apply**. A confirmation dialog box is displayed.
6. Click **Yes**. The settings are applied to the disk array.

Renaming Host Groups

To rename a host group:

1. From the SANtinel window, right-click **Host Group** or a host group. A pop-up menu is displayed.
2. Click **Add/Change** from the pop-up menu. The Add/Change Host Group window is displayed.

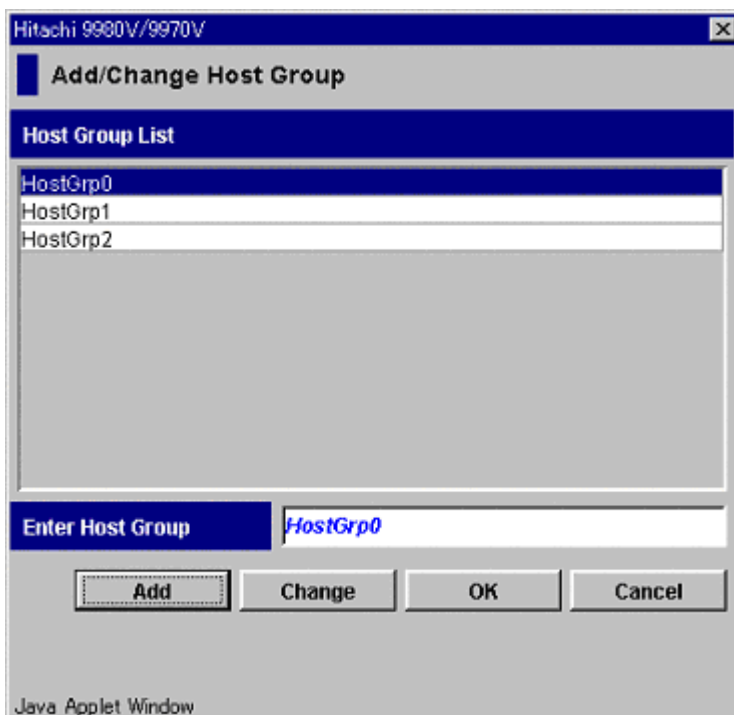


Figure 185 Add/Change Host Group window

3. In the Host Group List, click the host group you want to rename.
4. In the **Enter Host Group** box, enter the new name for the host group.

Host group names can be up to eight characters and are case-sensitive. The first character and the last character must not be a space. Also, the following characters are unusable in security group names: \ , / : ; * ? " < > |
5. Click **Change**. The change is reflected in the window.
6. Click **OK**.
7. From the SANtinel window, click **Apply**. A confirmation dialog box is displayed.
8. Click **Yes**. The settings are applied to the disk array.

Deleting Host Groups

To delete a host group:

1. From the SANtinel window, right-click the host group you want to delete. A pop-up menu is displayed.
2. Click **Delete** from the pop-up menu. A confirmation dialog box is displayed.
3. Click **Yes**.
4. Click **Apply**. A confirmation dialog box is displayed.
5. Click **Yes**. The settings are applied to the disk array.

Editing LDEV Groups

This section contains the following topics about editing LDEV groups:

- Deleting logical volumes from an LDEV group (see page 411)
- Renaming an LDEV group (see page 412)
- Deleting an LDEV group (see page 413)

You must operate Command View in Modify mode to perform SANtinel operations. Users in view mode can only view SANtinel information.

Deleting Logical Volumes from LDEV Groups

To delete logical volumes from an LDEV group:

1. From the SANtinel window, right-click an LDEV group. A pop-up menu is displayed.

2. Click **Specify** and then **LDEV** from the pop-up menu. The Select LDEV window is displayed.

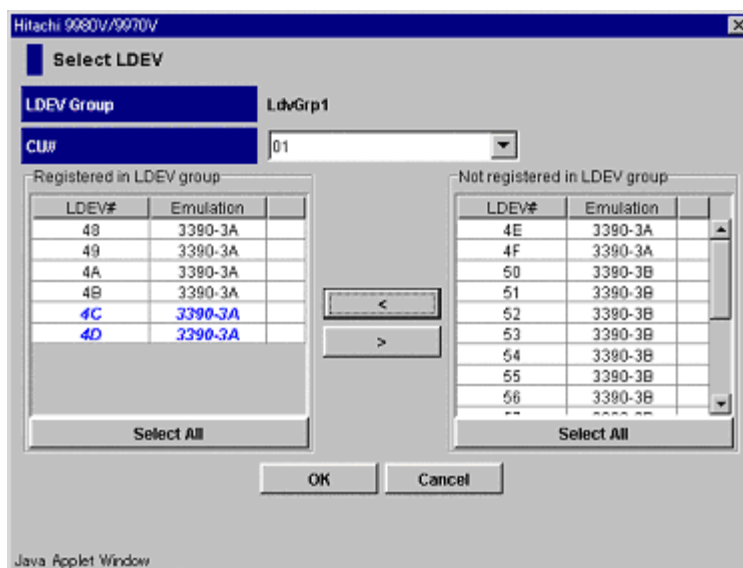


Figure 186 Select LDEV window

3. In the **CU#** list, click a CU image. The tables located below the list display the logical volumes in the CU image you selected. The Registered in LDEV group table displays the logical volumes registered in the LDEV group. The Not registered in LDEV group table displays logical volumes that are not registered in the LDEV group.
4. In the Registered in LDEV group table, click the logical volumes that you want to delete. Then, click the **>** button to move the selected logical volumes to the Not registered in LDEV group table.
5. To delete logical volumes in other CU images, repeat the previous steps.
6. Click **OK**.
7. From the SANtinel window, click **Apply**. A confirmation dialog box is displayed.
8. Click **Yes**. The settings are applied to the disk array.

Renaming LDEV Groups

To rename an LDEV group:

1. From the SANtinel window, right-click **LDEV Group** or an LDEV group. A pop-up menu is displayed.

2. Click **Add/Change** from the pop-up menu. The Add/Change LDEV Group window is displayed.



Figure 187 Add/Change LDEV Group window

3. In the LDEV Group List, click the LDEV group you want to rename.
4. In the **Enter LDEV Group** box, enter the new name for the LDEV group.
LDEV group names can be up to eight characters and are case-sensitive. The first character and the last character must not be a space. Also, the following characters are unusable in security group names: \ , / : ; * ? " < > |
5. Click **Change**. The change is reflected in the window.
6. Click **OK**.
7. From the SANtinel window, click **Apply**. A confirmation dialog box is displayed.
8. Click **Yes**. The settings are applied to the disk array.

Deleting LDEV Groups

To delete an LDEV group:

1. From the SANtinel window, right-click the LDEV group you want to delete. A pop-up menu is displayed.
2. Click **Delete** from the pop-up menu. A confirmation dialog box is displayed.
3. Click **Yes**.
4. Click **Apply**. A confirmation dialog box is displayed.
5. Click **Yes**. The settings are applied to the disk array.

Viewing Security Settings

This section explains how to view security settings for the following:

- Logical Volumes in a Specified Security Group (see page 414)

- Security Groups that Contains a Specified Host (see page 415)
- Ports through which Hosts Can Access Logical Volumes (see page 415)
- Logical Volumes in the Security Group that Contains a Specified Host (see page 416)
- Security Groups that Contain a Specified Logical Volume (see page 417)
- Hosts in the Security Group that Contains a Specified Logical Volume (see page 418)
- Security Groups that Contain a Specified Host Group (see page 419)
- Security Groups that Contain a Specified LDEV Group (see page 420)

Finding Logical Volumes in a Specified Security Group

To search a security group for logical volumes, click the security group in the tree view of the SANtinel window and then display the list of logical volumes in the lower-right table. Another method is described in the following procedure.

To find logical volumes in a specified security group:

1. In the tree view of the SANtinel window, right-click an item except for a host group or LDEV group that is displayed immediately below a security group.
2. From the pop-up menu, click **List -> Security Group to LDEV**. The Security Group to LDEV window is displayed.

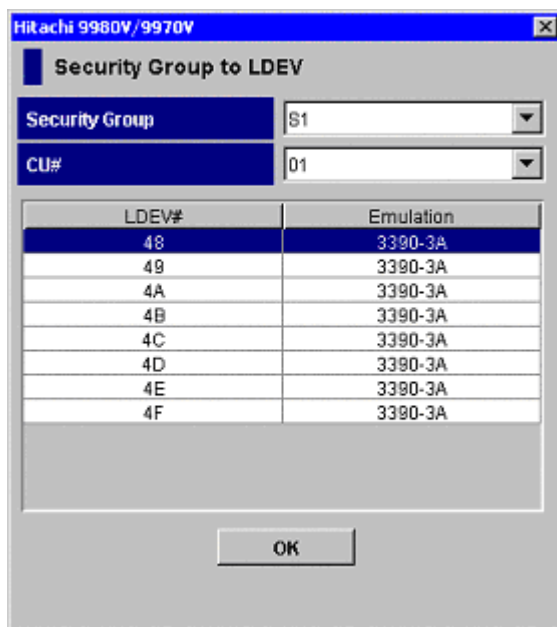


Figure 188 Security Group to LDEV window

3. In the **Security Group** list, click a security group.
4. Display the CU image numbers by clicking the down arrow to open the **CU#** list.
 - If one CU image number is listed, the table in the window displays all the logical volumes in the specified security group.
 - If two or more CU image numbers are listed, the table in the window currently displays some of the logical volumes in the specified security group. Click each CU image number to find logical volumes in the specified CU image.

Finding Security Groups that Contains a Specified Host

To specify a host and find the security groups in which the host is registered, complete one of the following procedures. Follow the first procedure if the host is displayed in the Hosts table (the upper-right table on the SANTinel window). Follow the second procedure if the host is not displayed in the Hosts table.

If the host is displayed in the Hosts table:

1. Right-click the host in the table.
2. From the pop-up menu, click **List -> Host to Security Group**. The Host to Security Group window is displayed.

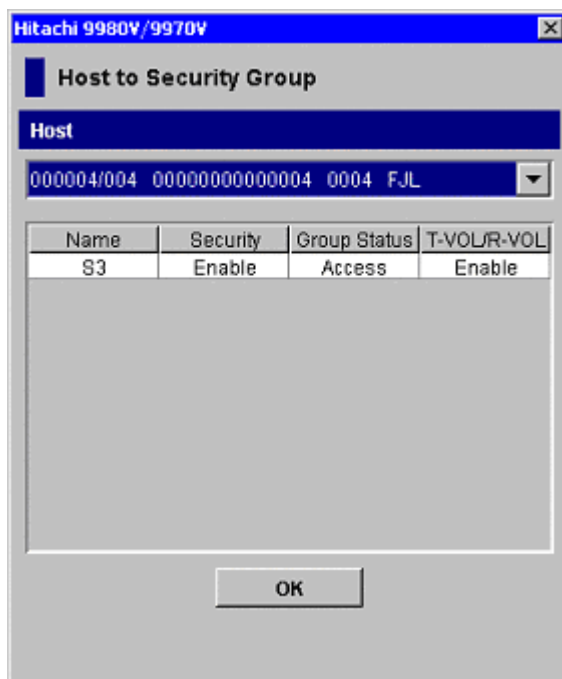


Figure 189 Host to Security Group window

If the host is not displayed in the Hosts table:

1. In the tree view of the SANTinel window, right-click an item except for a host group or LDEV group that is displayed immediately below a security group.
2. From the pop-up menu, click **List -> Host to Security Group**. The Host to Security Group window is displayed.
3. In the **Host** list, click the host. The table lists the security groups that you want.

Finding Ports Through which Hosts Can Access Logical Volumes

To find the ports through which a host can access logical volumes, you must have SANTinel Port Security Option installed.

To find the ports through which a host can access logical volumes:

1. In the tree view of the SANtinel window, right-click an item and then click **List -> Host Group to Port** from the pop-up menu. The Host Group to Port window is displayed.

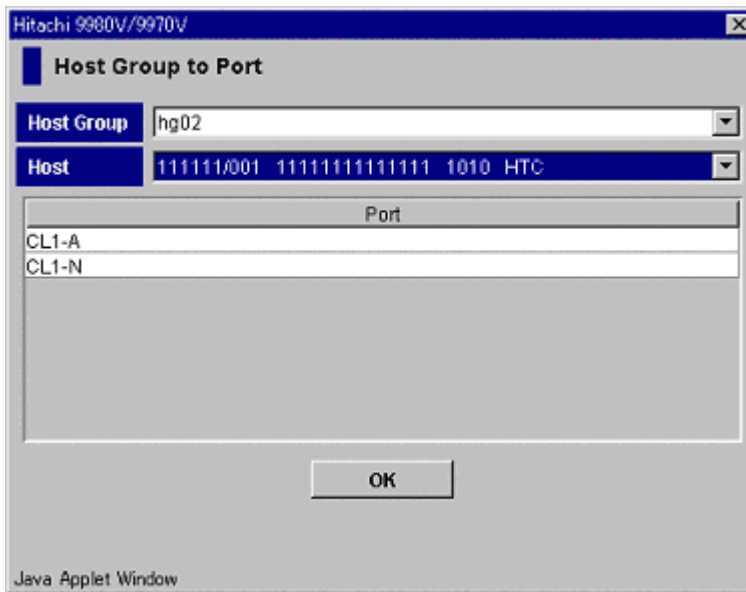


Figure 190 Host Group to Port window

2. In the **Host Group** list, click a host group.
3. In the **Host** list, click a host.
4. The Port list displays the ports through which the specified host can access logical volumes. Click **OK** to close the Host Group to Port window.

Finding Logical Volumes in the Security Group that Contains a Specified Host

If a security group is classified as an access group, the security group contains both host and logical volumes. The following procedures explain how to specify a host and to find logical volumes in the security group in which the specified host is registered. Follow the first procedure if the host is displayed in the Hosts table (the upper-right table on the SANtinel window). Follow the second procedure if the host is not displayed in the Hosts table.

If the host is displayed in the Hosts table:

1. Right-click the host in the table.

2. From the pop-up menu, click **List -> Host to LDEV**. The Host to LDEV window displays a list of logical volumes.

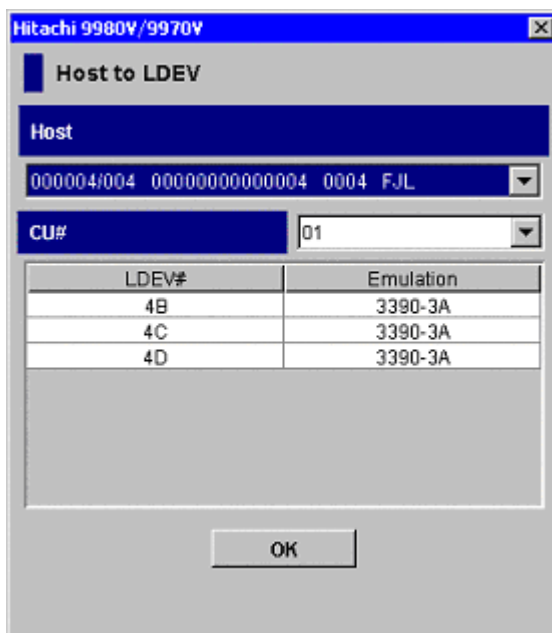


Figure 191 Host to LDEV window

3. Display the CU image numbers by clicking the down arrow to open the **CU#** list.
 - If one CU image number is listed, the table in the window displays all the logical volumes that you want.
 - If two or more CU image numbers are listed, the table in the window currently displays some of the logical volumes that you want. Click each CU image number to find logical volumes in the specified CU image.

If the host is not displayed in the Hosts table:

1. In the tree view of the SANtinel window, right-click an item except for a host group or LDEV group that is displayed immediately below a security group.
2. From the pop-up menu, click **List -> Host to LDEV**. The Host to LDEV window is displayed.
3. In the **Host** list, click the host. The table lists the security groups that you want.
4. Display the CU image numbers by clicking the down arrow to open the **CU#** list.
 - If one CU image number is listed, the table in the window displays all the logical volumes that you want.
 - If two or more CU image numbers are listed, the table in the window currently displays some of the logical volumes that you want. Click each CU image number to find logical volumes in the specified CU image.

Finding Security Groups that Contain a Specified Logical Volume

To specify a logical volume and find the security groups in which the logical volume is registered, complete one of the following procedures. Follow the first procedure if the logical volume is displayed in the LDEVs table (the lower-right table on the SANtinel window). Follow the second procedure if the logical volume is not displayed in the LDEVs table.

If the logical volume is displayed in the LDEVs table:

1. Right-click the logical volume in the table.

- From the pop-up menu, click **List -> LDEV to Security Group**. The LDEV to Security Group window is displayed. The table on the right displays a list of hosts.

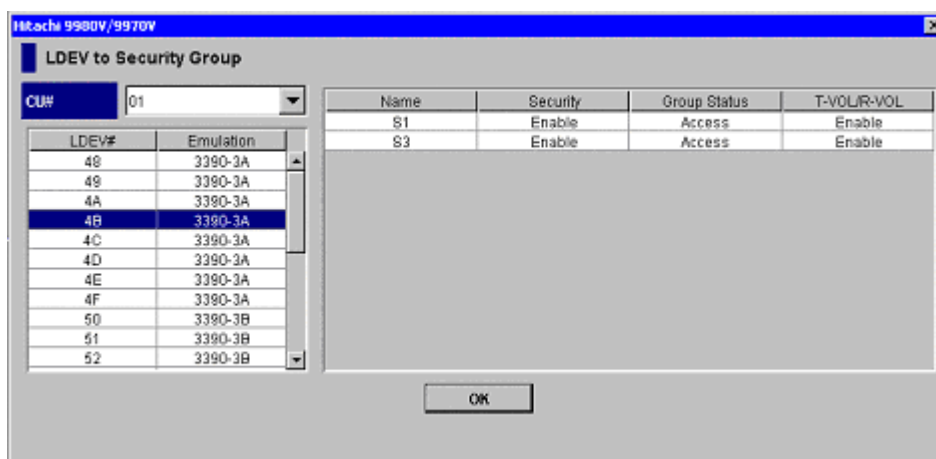


Figure 192 LDEV to Security Group window

If the logical volume is not displayed in the LDEVs table:

- In the tree view of the SANtinel window, right-click an item except for a host group or LDEV group that is displayed immediately below a security group.
- From the pop-up menu, click **List -> LDEV to Security Group**. The LDEV to Security Group window is displayed.
- In the **CU#** list, click a CU image number. Then, click an LDEV number from the lower-left table. The table on the right lists the security groups that you want.

Finding Hosts in the Security Group that Contains a Specified Logical Volume

If a security group is classified as an access group, the security group contains both host and logical volumes. The following procedures explain how to specify a logical volume and to find hosts in the security group in which the specified logical volume is registered. Follow the first procedure if the logical volume is displayed in the LDEVs table (the lower-right table on the SANtinel window). Follow the second procedure if the logical volume is not displayed in the LDEVs table.

If the logical volume is displayed in the LDEVs table:

- Right-click the logical volume in the table.

2. From the pop-up menu, click **List -> LDEV to Host**. The LDEV to Host window is displayed. The table on the right displays a list of hosts.

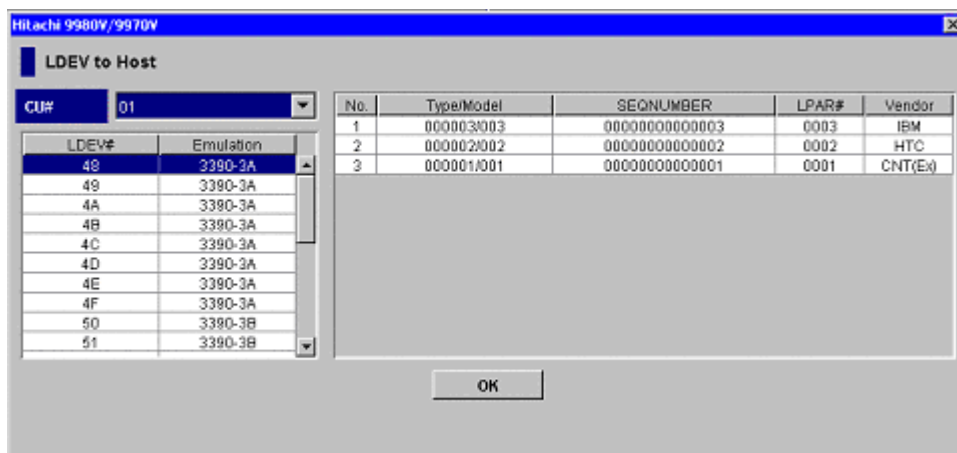


Figure 193 LDEV to Host window

If the logical volume is not displayed in the LDEVs table:

1. In the tree view of the SANtinel window, right-click an item except for a host group or LDEV group that is displayed immediately below a security group.
2. From the pop-up menu, click **List -> LDEV to Host**. The LDEV to Host window is displayed.
3. In the **CU#** list, click a CU image number. Then, click an LDEV number in the lower-left table. The table on the right lists the security groups that you want.

Finding Security Groups that Contain a Specified Host Group

To find security groups in which the specified host group is registered:

1. In the tree view of the SANtinel window, right-click an item except for a host group or LDEV group that is displayed immediately below a security group.

2. From the pop-up menu, click **List -> Host Group to Security Group**. The Host Group to Security Group window is displayed.



Figure 194 Host Group to Security Group window

3. In the **Host Group** list, click the host group. The table lists the security groups that you want.

Finding Security Groups that Contain a Specified LDEV Group

To find security groups in which the specified LDEV group is registered:

1. In the tree view of the SANtinel window, right-click an item except for a host group or LDEV group that is displayed immediately below a security group.

2. From the pop-up menu, click **List -> LDEV Group to Security Group**. The LDEV Group to Security Group window is displayed.



Figure 195 LDEV Group to Security Group window

3. In the **LDEV Group** list, click the LDEV Group. The table lists the security groups that you want.

General SANtinel Troubleshooting

SANtinel may display the Error Detail window when you attempt to apply security settings and an error occurs.

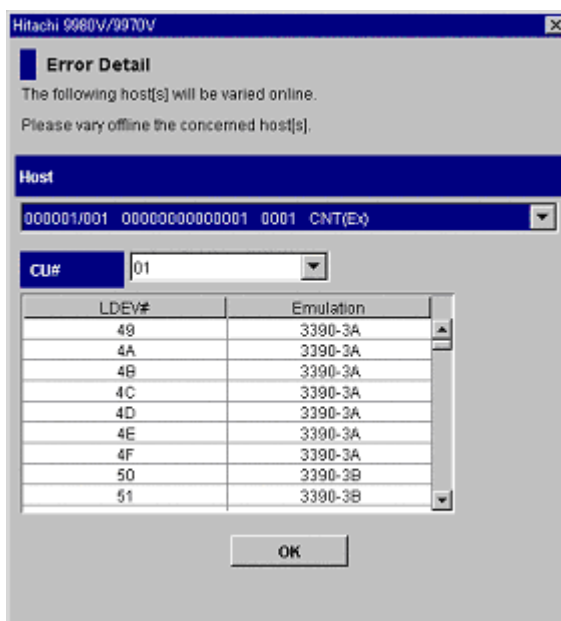


Figure 196 Error Detail window

The probable causes of the error are:

- Some hosts in one security group are accessing logical volumes in another security group.

- Some hosts do not belong to any security group, but the hosts are accessing logical volumes in a security group.

To correct this error, find the hosts and the logical volumes that cause the error.

To find the cause of the error:

1. In the Error Detail window, click the down arrow to open the **Host** list.
 - If the list displays one entry, only one host is causing the error.
 - If the list displays two or more entries, two or more hosts are causing the error.
2. In the **Host** list, click a host.
3. Display the CU image numbers by clicking the down arrow to open the **CU#** list.
 - If the list displays one entry, the table displays all the logical volumes that are causing the error.
 - If the list displays two or more entries, the table displays some of the error-causing logical volumes. To view other error-causing volumes, use the **CU#** list to specify another CU image.
4. If two or more hosts are causing the error, repeat [step 2](#) and [step 3](#).

If error-causing hosts and logical volumes are detected, do one of the following to remove the error:

- Vary the error-causing logical volume offline from the error-causing host. For detailed information about varying the volume offline, refer to the documentation for host commands.
- Find the security group that contains the error-causing hosts and the error-causing logical volumes. Then, disable the security settings of the security group (see ["Disabling Security"](#) on page 404).

5 LDEV Guard for the XP128/XP1024/XP12000

LDEV Guard protects data in your disk array from I/O operations performed on mainframe hosts. You can use LDEV Guard to assign an access attribute to each logical volume. If you use LDEV Guard, you will be able to use a logical volume as a read-only volume as well as protect a logical volume against both read and write operations.

LDEV Guard supports the following volume emulation types:

Table 120 Supported volume emulation types

Supported Volume Emulation Types	Description
3390-3, 3390-3R, 3390-9, 3390-L	These logical volumes can be used only by mainframe hosts.
3390-3A, 3390-3B, 3390-3C, 3390-9A, 3390-9B, 3390-9C, 3390-LA, 3390-LB, 3390-LC	<p>These logical volumes can be used by mainframe and open systems hosts.</p> <p>You must ensure that the access attribute of these logical volumes is Read/Write. For detailed information about access attributes, refer to "Assigning Access Attributes to Logical Volumes" on page 423.</p> <p>Access attributes only take effect when mainframe hosts access logical volumes. Access attributes does not take effect when open system hosts access logical volumes.</p>

Assigning Access Attributes to Logical Volumes

By default, all the mainframe volumes are subject to read and write operations by mainframe hosts. For this reason, data on mainframe volumes might be damaged or lost if a mainframe host performs erroneous write operations. Also, confidential data on mainframe volumes might be stolen if a malicious operator performs read operations on mainframe hosts.

However, if you use LDEV Guard, you can use logical volumes as read-only volumes to protect the volumes against write operations. You can also protect logical volumes against both read and write operations. LDEV Guard can restrict read operations and write operations on logical volumes, and prevent data from being damaged, lost, and stolen.

To restrict read and write operations, you must assign an access attribute to each logical volume. Use LDEV Guard to assign one of the following access attributes to each logical volume:

- **Read/Write:** If a logical volume has the Read/Write attribute, mainframe hosts can perform both read and write operations on the logical volume. All mainframe volumes have the Read/Write attribute by default.
- **Read Only:** If a logical volume has the Read Only attribute, mainframe hosts can perform read operations, but cannot perform write operations on the logical volume.
- **Protect:** If a logical volume has the Protect attribute, mainframe hosts cannot access the logical volume. Mainframe hosts cannot perform either read nor write operations on the logical volume.

To assign access attributes to logical volumes, start LDEV Guard and then edit a pattern in the LDEV Guard window. A pattern is a table that lists access attributes of all logical volumes. [Figure 197](#) is an example from a pattern. This example shows access attributes of the logical volumes 00, 01, and 02.

In [Figure 197](#), the access attribute of the logical volume 03 is displayed as Can't Guard, which indicates that you cannot assign any access attribute to the logical volume. You cannot use LDEV Guard to assign any access attribute to open system volumes and logical volumes (logical devices) that are not mapped to physical devices.

LDEV#	Attribute	Type	Capacity	VTOC (CC:HH)
00	Read/Write	3390-9	10,017 Cyl	-
01	Read Only	3390-9	10,017 Cyl	0:1 - 0:14 (14Trk)
02	Protect	3390-9	10,017 Cyl	-
03	Can't Guard	-	-	-

Figure 197 Example of a pattern

Use Command View when assigning access attributes. Also note the following:

- If a host computer attempts to write data to a read-only logical volume, the write operation fails and the host receives a Write Inhibit report that the host cannot write data because of the access attribute.
- If a host computer attempts to read data from or write data to a logical volume that has the Protect attribute, the attempted access is rejected and an intervention request is reported to the host. The intervention request indicates that the host cannot access the logical volume because of the access attribute.

Using Pattern Files

After you finish editing a pattern in the LDEV Guard window, you can save the pattern in a file. A pattern is a collection of access attributes of all logical volumes. If you create more than one pattern, you will be able to switch access attributes of logical volumes. You can create and save up to 32 pattern files. If you create two or more pattern files, you will be able to change access attributes of all logical volumes quickly and easily.



CAUTION: If a failure occurs in the SVP and then the SVP is replaced by a new one, your pattern files will be lost. To avoid losing your pattern files, make a backup copy by downloading your pattern files from the SVP to floppy disks, hard disks, or some other storage media. For more information about downloading pattern files, see ["Downloading a Pattern File"](#) on page 431.

The following figure is an example of a computer system that uses two pattern files (Ptn_1 and Ptn_2). In Ptn_1, the logical volume *ldev 1* has the *Read/Write* attribute, and the logical volume *ldev2* has the *Protect* attribute. In Ptn_2, *ldev1* has the *Read Only* attribute, and *ldev2* has the *Read/Write* attribute. The system administrator applies Ptn_1 to the disk array during the day, and applies Ptn_2 at night. During the day, all the hosts can read and write to *ldev1*, but can neither read from nor write to *ldev2*. At night, all hosts can read data from *ldev1*, and can read from and write to *ldev2*.

For detailed instructions on how to create and use pattern files, see “Using LDEV Guard” on page 429.

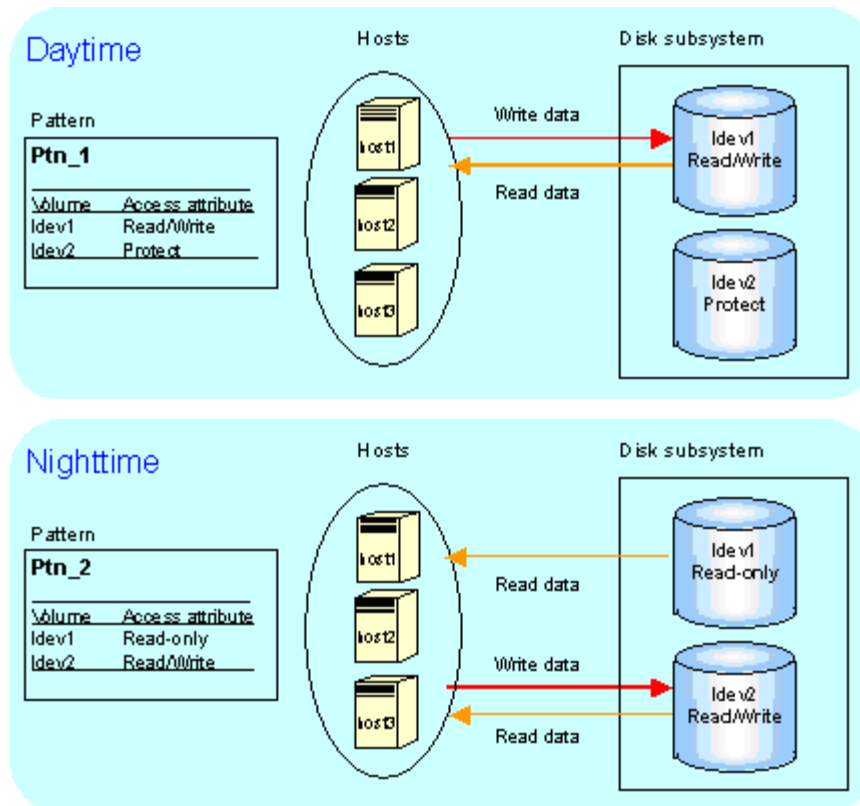


Figure 198 Example of using pattern files

Using LDEV Guard with Other Products

Do not perform LDEV Guard operations if any other program product is running. Also, do not assign an access attribute to a logical volume if any job is manipulating data on the logical volume. If you assign an access attribute to such a logical volume, the job will possibly end abnormally.

- **TrueCopy (Synchronous and Asynchronous):** Do not assign an access attribute to any logical volume that is being used by TrueCopy. If you assign an access attribute, the job will end abnormally.

If you want to create a TrueCopy pair and to use a read-only volume as the main volume (M-VOL), you are recommended to find the remote volume (R-VOL) from a disk array on which LDEV Guard is enabled. If you need to find the R-VOL from a disk array on which LDEV Guard is not enabled, you must do either of the following:

- Change the access attribute of the M-VOL to Read/Write
- Disable LDEV Guard on the main site

If you use TrueCopy to create a pair, the main volume (M-VOL) and the remote volume (R-VOL) will have the same access attribute. If you suspend or delete the pair, access attribute for these volumes will not change.

If a remote copy pair is suspended during a TrueCopy copy operation and you want to enable the R-VOL read option on the RCU (mode 20), you must ensure that the access attribute of the R-VOL is Read/Write before you enable the R-VOL read option.

If the access attribute of the R-VOL is Read-Only, mode 20 will be disabled. Also, operations such as REFORMAT and REFVTOC cannot be performed for overwriting volume serial numbers.

If a logical volume has the Protect attribute, the logical volume can neither be used as an M-VOL nor an R-VOL.

- **ShadowImage:** If a logical volume has the Protect attribute, the logical volume can neither be used as a source volume (S-VOL) nor a target volume (T-VOL).
- **Other products that can automatically start at a specified time:** If any program product that can start automatically is enabled, you must either perform LDEV Guard operations when the program is not running or cancel the setting of the program start time.

Requirements for LDEV Guard

In addition to meeting the minimum Command View installation requirements, and installing Command View and the LDEV Guard license key, you need to install Java Web Start 1.2 before using LDEV Guard.

Java Web Start

Configuration File Loader uses Java Web Start 1.2 to transfer (upload and download) a spreadsheet file to the disk array. Java Web Start is a utility that allows Command View XP to execute a program locally from your browser to upload and download configuration files directly to and from the disk array.

If you are using Windows, Java Web Start is automatically installed when you installed JRE 1.4.2. You should not need to install Java Web Start separately.

If you are using HP-UX, Java Web Start is **not** installed when you installed JRE/RTE 1.4.1.03 and must be installed separately. The Java Web Start file is located in the `jre` directory. To install Java Web Start 1.2, refer to the instructions in the release notes or go to

http://www.hp.com/products1/unix/java/java2/webstart/infolibrary/rnotes_webstart_1-2.html.

Starting LDEV Guard

To assign access attributes, you must use a user account that has the write permission, such the Administrator account, and you must be in Modify mode. If you use a user account that does not have the write permission or you are in View mode, you will be able to view access attributes, but you will be unable to assign access attributes.

To start LDEV Guard:

1. From the Launch window, click an XP128, XP1024, or XP12000.

- Click the **Mainframe** tab, click the **Mainframe Connection** button () , and then click the **LDEV Guard** tab. The LDEV Guard window is displayed.

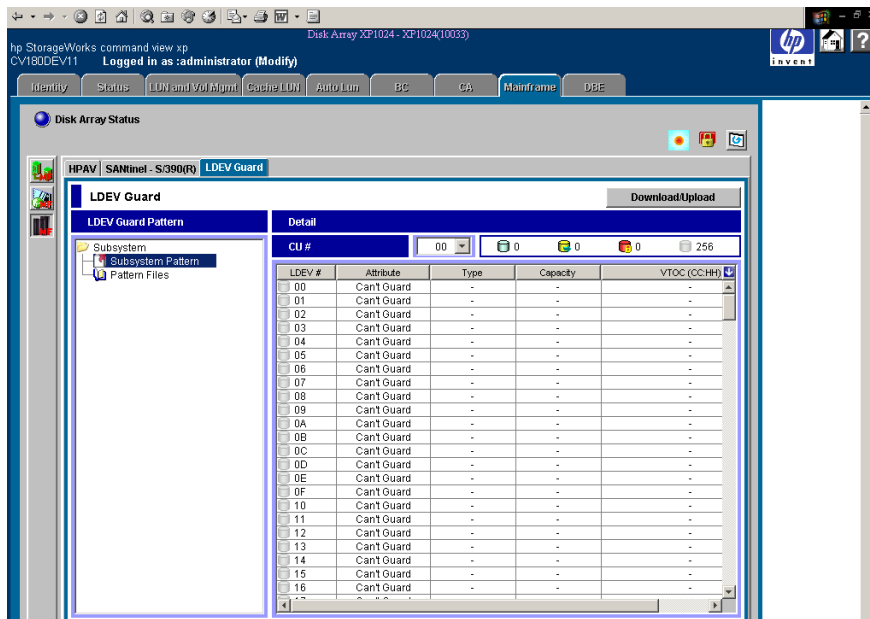


Figure 199 LDEV Guard window

LDEV Guard Window

The LDEV Guard window is displayed when you start LDEV Guard and is the starting point for all the LDEV Guard operations. The LDEV Guard window displays the following items:

LDEV Guard Pattern tree

This tree displays a list of patterns and contains the following folders:

- **Subsystem Pattern:** Contains the pattern that is currently applied to the disk array. Click this folder to display the pattern in the Detail table.
- **Pattern Files:** Contains a list of pattern files. Click a pattern file to display the file contents in the Detail table.

Download/Upload button

Clicking this button displays the Download/Upload Pattern File window, which you can use to download and upload pattern files. This button is available if you are in Modify mode, except when editing pattern file(s). For instance, this button is not available when any item is displayed in blue and italics in the LDEV Guard Pattern tree or the Detail table.

Detail table

Displays the contents of the pattern selected in the LDEV Guard Pattern tree.

- **CU# list:** Used to specify a CU image. If you specify a CU image, the Detail table displays logical volumes in the CU image. To the right of this list are four icons:

Table 121 LDEV Guard icons





Icon	Status
	Logical volumes that have the Read/Write attribute.
	Logical volumes that have the Read Only attribute.


Table 121 LDEV Guard icons (continued)

Icon	Status
	Logical volumes that have the Protect attribute.
	Open systems volumes and logical volumes (logical devices) that are not mapped to any physical storage devices. You cannot assign any access attribute to these volumes.

The Detail table lists logical volumes and the access attribute of each logical volume. The table contains the following columns:

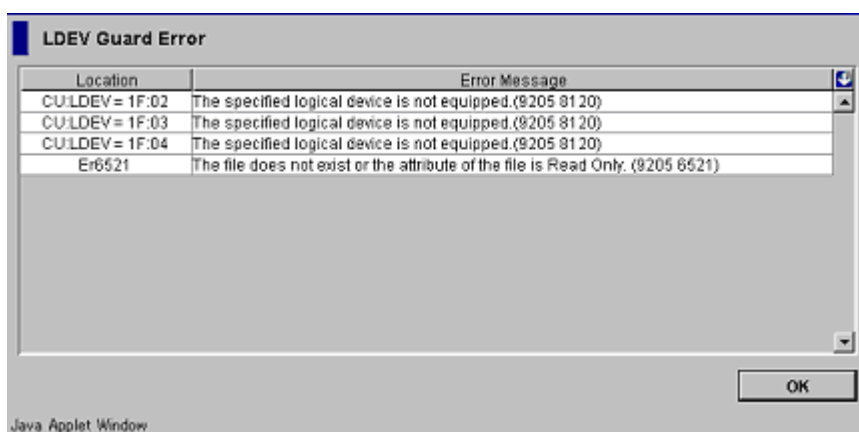
- **LDEV#:** Displays logical volume numbers. The LDEV Guard icons shown in [Table 121](#) display additional information about each volume.
- **Attribute:** Indicates the access attribute of each logical volume. If this column displays **Can't Guard**, you cannot assign any access attribute to the logical volume.
- **Type:** Displays volume emulation types.
- **Capacity:** Displays the capacity of each logical volume. The unit is cylinder (Cyl.).
- **VTOC (CC:HH):** Displays the range of the VTOC area. Also displays the number of tracks in the VTOC area. **CC** indicates the cylinder number. **HH** indicates the head number.

For example, if **0:1-0:14(14Trk)** is displayed, the starting point for the VTOC area is cylinder 0 and head 0. The ending point for the VTOC area is cylinder 0 and head 14. The number of tracks are 14.

-  **button:** Located in the upper-right corner of the table and selects all the logical volumes in the table.
- **Apply button:** Applies settings in the LDEV Guard window to the disk array.
- **Cancel button:** Discards settings in the LDEV Guard window.

LDEV Guard Error Window

The LDEV Guard Error window is displayed when an error occurs in LDEV Guard operations, and displays error locations and messages.

**Figure 200** LDEV Guard Error window

The LDEV Guard Error window displays the following items:

- **Location:** Indicates where the error occurred. If an error occurs with a logical volume, this column displays the CU number and the LDEV number. If an error occurs with a pattern file, this column displays the name of the pattern file.

- **Error Message:** Displays the error message.
- **OK button:** Closes the LDEV Guard Error window.



Using LDEV Guard

LDEV Guard topics include the following:

- Changing access attributes of logical volumes (see page 429)
- Creating a pattern file (see page 429)
- Editing a pattern file (see page 430)
- Applying a pattern file to the disk array (see page 431)
- Renaming a pattern file (see page 431)
- Deleting a pattern file (see page 431)
- Downloading a pattern file (see page 431)
- Uploading a pattern file (see page 432)
- Specifying the VTOC size (see page 433)

Changing Access Attributes of Logical Volumes

To change access attributes of logical volumes:

1. From the LDEV Guard window, click **Subsystem Pattern** in the LDEV Guard Pattern tree. The current pattern (the current access attributes of logical volumes) is displayed in the table.
2. Confirm that the  icon is displayed next to the selected pattern. If the icon is not next to the selected pattern, right-click **Subsystem Pattern**. A pop-up menu is displayed.
3. Click **Use as Subsystem Pattern** from the pop-up menu.
4. In the **CU#** list, click a CU image. The table displays a list of logical volumes in the specified CU image. Access attributes are displayed on the right of logical volume names.
5. Select and right-click a logical volume whose access attribute you want to change. If you want to assign the same access attribute to all logical volumes in the table, click the  button in the upper-right corner of the table and then right-click. A pop-up menu is displayed.
6. From the pop-up menu, click **Attribute** and then click the access attribute you want to assign. The logical volume is displayed in italics and in blue when the access attribute changes. The volume icon also changes when the access attribute changes. If you want to change access attribute of other logical volumes, repeat this step.
7. If you want to change access attributes of logical volumes in other CU images, repeat [step 4](#) - [step 6](#).
8. Click **Apply**. A confirmation dialog box is displayed.
9. Click **OK**. The settings are applied to the disk array.

Creating a Pattern File

When creating a pattern file for the first time, copy the pattern that is currently applied to the disk array, and then save the copy as a new pattern file. If you already have pattern files, you can create a pattern file by copying an existing pattern file or by copying the pattern that is currently applied to the disk array.

When you create pattern files, the pattern files will be saved. You can also download pattern files you have created. For more information about downloading pattern files, see ["Downloading a Pattern File"](#) on page 431.

To create a pattern file:

1. From the LDEV Guard window, do one of the following:

- To copy the pattern that is currently applied to the disk array, right-click **Subsystem Pattern** from the LDEV Guard Pattern tree and then click **Copy** from the pop-up menu.
- To copy an existing pattern file, right-click a pattern file from the Pattern Files folder of the LDEV Guard Pattern tree and then click **Copy** from the pop-up menu.

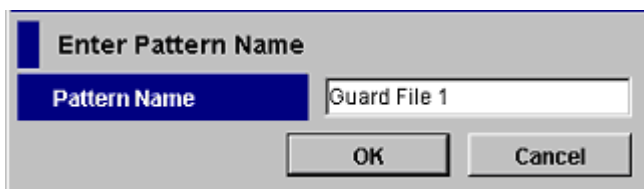



Figure 201 Enter Pattern Name window

2. In the Enter Pattern Name window, enter the name of the new pattern file. The following conventions apply to names of pattern files:

- Up to 16 characters can be used.
- The first character and the last character must not be a space.
- The following characters cannot be used: \ . , / : ; * ? " < > |

3. Click **OK**. The name of the new pattern file is displayed in the LDEV Guard Pattern tree. The pattern file name is displayed in blue and preceded by the  icon.

4. Click **Apply**. A confirmation dialog box is displayed.

5. Click **OK**. The new pattern file is saved. The pattern file turns black and the pattern file icon also changes to the  icon.

Editing a Pattern File

To edit a pattern file:

1. From the LDEV Guard window, click a pattern file from the LDEV Guard Pattern tree. The table displays the contents of the pattern file.

2. In the **CU#** list, click a CU image. The table displays a list of logical volumes in the specified CU image. Access attributes are displayed on the right of logical volume names.

3. Select and right-click a logical volume whose access attribute you want to change. A pop-up menu is displayed.

4. From the pop-up menu, click **Attribute** and then click the access attribute. The logical volume is displayed in blue when the access attribute changes. If you want to change access attribute of other logical volumes, repeat this step.

5. If you want to change access attributes of logical volumes in other CU images, repeat [step 2](#) - [step 4](#).


6. Click **Apply**. A confirmation dialog box is displayed.

7. Click **OK**. The changes are saved in the pattern file.

Applying a Pattern File to the Disk Array

If you follow the procedure below to apply a pattern file to the disk array, the access attributes of all logical volumes will change as defined in the pattern file.

To apply a pattern file to change access attributes of all logical volumes:



1. From the LDEV Guard window, right-click a pattern file from the Pattern Files folder of the LDEV Guard Pattern tree and then click **Use as Subsystem Pattern** from the pop-up menu. The pattern file is displayed in italics and in blue. The pattern file icon also changes to the  icon.
2. Click **Apply**. A confirmation dialog box is displayed.
3. Click **OK**. The pattern file is applied to the disk array. Access attributes of logical volumes change as defined in the pattern file. To confirm that the access attributes have been changed, right-click **Subsystem Pattern** in the LDEV Guard Pattern tree and then view the table.

Renaming a Pattern File

The following conventions apply to names of pattern files:


- Up to 16 characters can be used.
- The first character and the last character must not be a space.
- The following characters cannot be used: \ . , / : ; * ? " < > |

To rename a pattern file:

1. From the LDEV Guard window, right-click a pattern file in the LDEV Guard Pattern tree and then click **Rename** from the pop-up menu. The Enter Pattern Name window is displayed.
2. Enter the new name for the pattern file and then click **OK**. The pattern file is renamed in the LDEV Guard Pattern tree and displayed in italics and in blue. The pattern file icon also changes to the  icon.
3. Click **Apply**. A confirmation dialog box is displayed.
4. Click **OK**. The change to the pattern file name is applied. The pattern file turns black and the pattern file icon also changes to the  icon.

Deleting a Pattern File

To delete a pattern file:

1. From the LDEV Guard window, right-click a pattern file in the LDEV Guard Pattern tree and then click **Delete** from the pop-up menu. The pattern file name is displayed in italics and in blue. The pattern file icon also changes to the  icon.
2. Click **Apply**. A confirmation dialog box is displayed.
3. Click **OK**. The pattern file is deleted.

Downloading a Pattern File

All of the pattern files you have created with LDEV Guard are saved. If a failure occurs in the SVP and then the SVP is replaced by a new one, your pattern files will be lost. To avoid losing your pattern files, make a backup copy by downloading your pattern files to floppy disks, hard disks, or some other storage media. To make a backup copy, download the pattern files you have created.



NOTE: For more information about uploading pattern files to a new SVP, refer to "Uploading a Pattern File" on page 432.

To download a pattern file:

1. From the LDEV Guard window, click **Download/Upload**. The Download/Upload Pattern File window is displayed (Figure 202).



NOTE: If the **Download/Upload** button is not available and you have installed Java Web Start 1.2, verify that you are not in the process of making changes to the pattern files. If a pattern file name is displayed in italics and in blue, the file is either new or has been changed. You must first click **Apply** to save any changes or **Cancel** to discard any changes before downloading a pattern file.

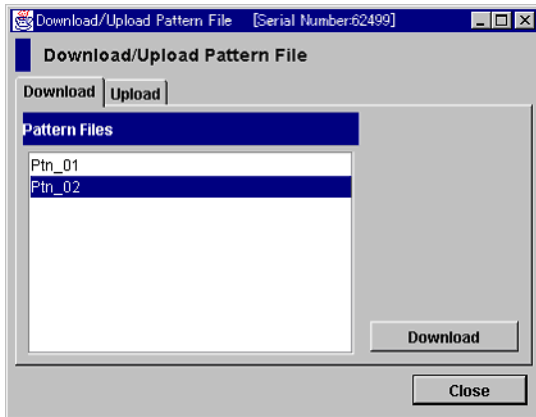


Figure 202 Download/Upload Pattern File window (Download tab)

2. From the **Pattern Files** list box, click the pattern file you want to download.
3. Click **Download**. The Choose Pattern File dialog box is displayed.
4. Navigate to the directory in which to save the pattern file, and then enter the file name in the **File name** box.
5. Click **Save** to start downloading the pattern file. When the download has completed, a confirmation dialog box is displayed.
6. Click **OK** and then click **Close** to close the Download/Upload Pattern File window.

Uploading a Pattern File

If a failure occurs in the SVP and then the SVP is replaced by a new one, you need to upload the backup copy of your pattern files.

Uploading a pattern file does not apply access attributes defined in the pattern file. If you want to apply the uploaded pattern file to change the access attributes of your disk array, see ["Applying a Pattern File to the Disk Array"](#) on page 431.

To upload a pattern file:

1. From the LDEV Guard window, click **Download/Upload**. The Download/Upload Pattern File window is displayed (Figure 203).



NOTE: If the **Download/Upload** button is not available and you have installed Java Web Start 1.2, verify that you are not in the process of making changes to the pattern files. If a pattern file name is displayed in italics and in blue, the file is either new or has been changed. You must first click **Apply** to save any changes or **Cancel** to discard any changes before uploading a pattern file.

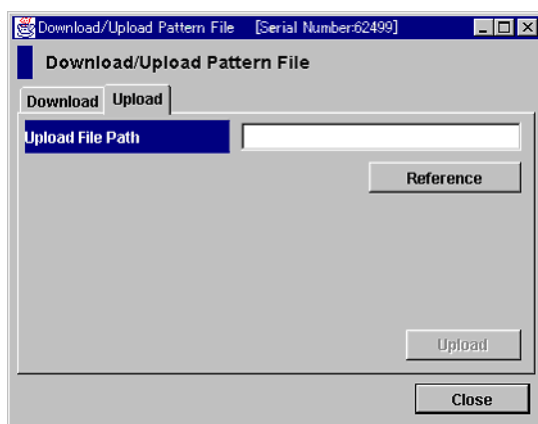


Figure 203 Download/Upload Pattern File window (Upload tab)

2. In the **Download/Upload Pattern File** window, click the **Upload** tab.
3. Click **Reference**. The Choose Pattern File dialog box is displayed.
4. Navigate to the directory containing the pattern file, and then click the pattern file.
5. Click **Open**. The specified directory is displayed in the **Upload File Path** box and the **Upload** button becomes available.
6. Click **Upload** to start uploading the pattern file. When the upload has completed, a confirmation dialog box is displayed.
7. Click **OK** and then click **Close** to close the Download/Upload Pattern File dialog box.

Specifying the VTOC Size

When a host accesses a logical volume, the VTOC (volume table of contents) in the logical volume is updated to include updated access logs. If Read Only attribute is assigned to a logical volume, you can resize the VTOC in the logical volume by following the procedure below:

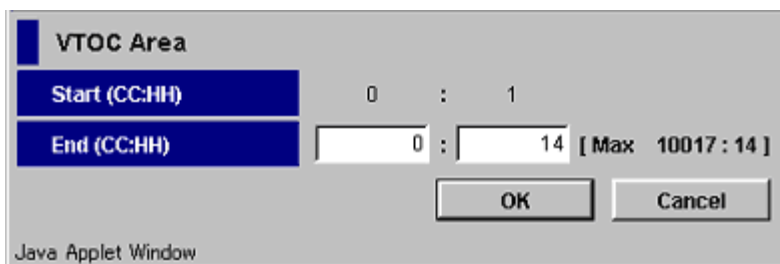
To specify the size of the VTOC in a logical volume:

1. From the LDEV Guard window, click **Subsystem Pattern** from the LDEV Guard Pattern tree.
2. Select one or more read-only logical volumes from the table and right-click. A pop-menu is displayed.



NOTE: You cannot resize the VTOC if the selected logical volume is not read-only. Also, to select two or more logical volumes, you must select logical volumes that have the same capacity.

- Click **VTOC** from the pop-up menu. The VTOC Area window is displayed.



VTOC Area

Start (CC:HH) 0 : 1

End (CC:HH) 0 : 14 [Max 10017 : 14]

OK Cancel

Java Applet Window

Figure 204 VTOC Area window

- Use the **End (CC:HH)** boxes to specify the ending position of the VTOC. Enter the cylinder number in the first box and the head number in the second box.



NOTE: The starting position of the VTOC cannot be changed and is always 0:1, which indicates the cylinder number 0 and the head number 1.

- Click **OK**.
- Click **Apply**. A confirmation dialog box is displayed.
- Click **OK**. The change is applied to the disk array.

Index

A

- adding
 - consistency group 109, 110
 - new pairs using PPRC 294
 - path to RCU 102
 - RCU path 102
 - SSID to RCU 104
- applying
 - pattern files 431
- At-Time Split function
 - SI390 244
- audience 19
- authorized reseller, HP 21

B

- base and alias devices
 - defining 369

C

- cache
 - requirements for TC390 56
- CDELPAR for TC390A 169
- CESTPAIR for TC390A 166
- CESTPATH SAID parameters 166
- CGROUP (FREEZE/RUN) 174
 - FREEZE option 175, 176
 - GDPS environment 177
 - requirements 174
 - RUN option 177
 - SSID requirements 175
 - SVP modes 176
- changing
 - access attributes of logical volumes 429
 - consistency group options 111
 - RCU options 101
 - volume pair options 141
 - WLM PAV settings 383
- configuring
 - async options 112
 - MCU ports 91
 - MCUs and RCUs for FC 64
 - MCUs and RCUs for serial interface 63
- consistency group
 - adding 109, 110
 - changing options 111
 - deleting 112, 114
 - deleting all pairs in group 139
 - options 109, 110
 - resuming 136
 - viewing status 107

- conventions
 - document 20
 - text symbols 20
- CQUERY
 - for CGROUP 180
 - for TC390A 171
- creating
 - pattern files 429
 - volume pairs 126, 131
- CRECOVER for TC390A 170
- CSUSPEND for TC390A 168
- CSUSPEND/QUIESCE TSO command 149
- CTG screen 281
- currency of R-VOLs 150

D

- data migration
 - using TC390 143
- database recovery 148
- defining
 - base and alias devices 369
 - XP1024 LCU 369
- deleting
 - consistency group 112, 114
 - path to RCU 103
 - pattern files 431
 - RCU 101
 - RCU path 103
 - RCUs 101
 - SSID from RCU 104, 105
 - volume pairs 139, 277
 - volume pairs using PPRC 299
- device blocking
 - HXRC 225
 - TC390 168
- DEVSERV commands 293, 294
- DFW requirements for TC390 56
- disaster recovery
 - clearing SIMs 149
 - consistency of async R-VOLs 151
 - currency of sync R-VOLs 150
 - file and database recovery procedures 148
 - M-VOL fence level 147
 - preparing for 146
 - resuming normal operations 152
 - switching to the remote site 149
 - timer type for TC390A in reverse 151
 - transferring back to the main site 151
 - transferring sense information through ERC 148
- discontinuing
 - TC390 operations 120

- displaying
 - consistency group status 107
 - HPAV device parameters 379
 - pair status using PPRC 294
 - RCU status 91
 - TC390 pair status information 123
- document
 - conventions 20
 - prerequisites 19
 - related documentation 19
- documentation, HP web site 20
- downloading
 - pattern files 431
- dummy pair mode 167
- dynamic HPAV 353, 354

E

- editing
 - pattern files 430
- ERC 148
- error codes 160
- error reporting communications 148

F

- failure conditions 182
- fibre remote copy connections 58
- file recovery 148

G

- GDPS 174
- group
 - Delete Pair option 139
 - Resume Pair option 136
 - TC390A pair option 76, 130
 - TC390A suspend option 133
- GTF I/O tracing 366

H

- help, obtaining 21
- Host I/O Performance option
 - SI390 244
- HP
 - authorized reseller 21
 - storage web site 21
 - Subscriber's choice web site 21
 - technical support 21

HPAV

- assigning aliases 360
- canceling aliases 362
- defining device parameters 379
- maximizing results 356
- overview 351
- performing operations 360
- preparing host system 358
- requirements 355
- restrictions 355
- system requirements 357
- verifying device status 364

- verifying devices 364

HXRC 28, 176

I

- ICKDSF
 - media maintenance on TC390 volumes 142
 - PPRCOPY commands 161
- ICKDSF commands. See PPRC commands
- IEA491E system console message 180, 181
- IEA494I system console message 149, 181
- installing
 - TC390 hardware 57
 - TC390 software 62
 - TC390 system requirements 53

J

- Java Web Start 426

L

- LDEV Guard 423
 - LDEV Guard screen 427
 - starting 426
- logical path. See path
- logical volumes
 - changing access attributes 429
 - specifying VTOC size 433

M

- MCU
 - CGROUP requirements 175
 - configuring FC 64
 - configuring ports 91
 - configuring serial interface 63
 - outage 145
- migrating
 - data 143
- migration
 - using TC390 143
- MIH timer value 359
- modes
 - for TC390 (and HXRC) 28
- modifying
 - consistency group options 111
 - parameters 113
 - RCU options 101
 - RCU, Path, or SSID parameters 105
 - volume parameters 123
- M-VOL
 - fence level 127, 147
 - performing ICKDSF on 142
 - pinned track 190
- MVS commands 365

N

- NVS
 - TC390 requirements 56

O

- omitting
 - RCU, Path, or SSID from the operation 106
 - selected volumes 123
- operations
 - reserve 235
 - reset reserve 235
- options
 - Suspend Pair 132

P

- pair settings operation 121
- pair status 246
 - during CGROUP operations 177
 - troubleshooting 157
- parameters
 - modifying 113
 - modifying volumes 123
- path
 - adding 102
 - deleting 103
 - status descriptions 93
 - troubleshooting 155
- pattern file
 - applying 431
 - creating 429
 - deleting 431
 - editing 430
 - renaming 431
- pattern files
 - downloading 431
 - uploading 432
- performing
 - asynchronous operations 106
 - HPAV operations 360
 - ICKDSF on a M-VOL 142
 - ICKDSF on a R-VOL 142
 - pair settings operation 121
 - planned outage of MCU and RCU 146
 - RCU operations 89
- pinned track 189, 313
- PiT
 - producing duplicate consistency group 144
- point-in-time copy 144
- power off/on requirements 144
- PPRC 160
 - for TC390A 163
 - ICKDSF PPRCOPY commands 161
 - restrictions for TC390 51
- PPRC commands
 - ATQUERY 301
 - ATSPILT 300
 - DELPART 299
 - ESTPART 294
 - ESTPART MODE(RESYNC) 299
 - parameters 285
 - QUERY 294
 - restrictions 291

- SI390 and TC390 operability 292
- SUSPEND 297
- preparing
 - host system for HPAV operations 358
- prerequisites 19
- producing
 - PiT duplicate consistency group 144
- PSF commands 293

R

- RCU
 - adding path 102
 - adding SSID 104
 - configuring FC 64
 - configuring serial interface 63
 - deleting 101
 - deleting path 103
 - deleting SSID 105
 - operations 88
 - outage 145
 - path status 93
 - performing operations 89
 - registering 93
 - status 91
- registering
 - RCU 93
 - RCU to connected MCU 95
- related documentation 19
- Remote Copy monitoring
 - starting 114
 - stopping 114
- renaming
 - pattern files 431
- reserve attribute 235
 - resetting 267
 - setting 266
- resuming
 - consistency group 136
 - volume pairs 136
- resynchronizing
 - using PPRC 299
- resynchronizing pairs 273
- R-VOL
 - analyzing currency of 150
 - analyzing TC390A consistency of 151
 - performing ICKDSF on 142
 - pinned track 190

S

- SAID parameters 166
- SANtinel 387
 - access groups 387
 - applying security 394
 - classifying security groups 399, 401
 - creating host groups 395
 - creating LDEV groups 398
 - creating security groups for use as a pool group 401
 - creating security groups for use as an access group 399

- deleting host groups [411](#)
- deleting hosts from host groups [408](#)
- deleting LDEV groups [413](#)
- deleting logical volumes from LDEV groups [411](#)
- deleting ports from host groups [409](#)
- deleting security groups [406](#)
- disabling security [394](#), [404](#)
- editing host groups [407](#)
- editing LDEV groups [411](#)
- editing security groups [405](#)
- editing security settings [405](#)
- emulation types [391](#)
- enabling hosts to access logical volumes [395](#)
- enabling specified hosts to access logical volumes [387](#)
- finding hosts in the security group that contains a specified logical volume [418](#)
- finding logical volumes in a security group [414](#)
- finding logical volumes in the security group that contains a specified host [416](#)
- finding ports through which hosts can access logical volumes [415](#)
- finding security groups that contain a specified host group [419](#)
- finding security groups that contain a specified LDEV group [420](#)
- finding security groups that contain a specified logical volume [417](#)
- finding security groups that contains a specified host [415](#)
- LDEV security [387](#)
- LDEVs [387](#)
- logical devices [387](#)
- logical partitions [394](#)
- LPARs [394](#)
- maximum number of groups [391](#)
- PCB types [391](#)
- pool groups [389](#)
- port-level security [387](#), [388](#)
- prohibiting hosts from accessing logical volumes [389](#), [401](#)
- protecting logical volumes from erroneous remote copy operations [390](#)
- protecting logical volumes from I/O operations [387](#)
- protecting logical volumes from remote copy operations [403](#)
- registering host and LDEV groups in a security group [400](#)
- registering hosts in a host group [396](#)
- registering hosts to be attached to the disk array [407](#)
- registering LDEV groups in a security group [402](#)
- registering logical volumes in an LDEV group [398](#)
- registering ports in a host group [397](#)
- renaming host groups [410](#)
- renaming LDEV groups [412](#)
- renaming security groups [406](#)
- restrictions [390](#)
- secondary volumes [390](#)
- starting [392](#)
- system requirements [387](#)
- troubleshooting [421](#)
- unregistering host groups from a security group [405](#)
- unregistering LDEV groups from a security group [405](#)
- viewing security settings [413](#)
- scripting [84](#), [195](#)
 - ChangeHrcPair command [205](#)
 - components [198](#)
 - CreateHrcPair command [199](#)
 - DeleteHrcPair command [202](#)
 - functional macro commands [196](#)
 - GetHrcStatus command [206](#)
 - internal macro commands [197](#), [209](#)
 - parameter restrictions [198](#)
 - result value [213](#)
 - ResumeHrcPair command [204](#)
 - SelectHrcDevice command [207](#)
 - StartHrcPair command [206](#)
 - SuspendHrcPair command [203](#)
 - symbols [199](#)
 - syntax description [197](#)
- setting
 - asynchronous option parameters [113](#)
 - MIH timer value [359](#)
 - WLM operation mode [358](#)
- ShadowImage. See [SI390](#)
- shared SI390/TC390 volumes [252](#), [255](#)
- SI390
 - add pair operation [236](#)
 - adding pairs [268](#)
 - At-Time Split function [244](#)
 - combining with other features [251](#)
 - components [231](#)
 - delete pair operation [242](#)
 - deleting pairs [277](#)
 - Host I/O Performance option [244](#)
 - initial copy operation [236](#)
 - operations [235](#)
 - preparing for operations [250](#)
 - requirements [233](#)
 - resync pair operations [238](#)
 - resynchronizing pairs [273](#)
 - sharing volumes with TC390 [121](#), [252](#)
 - split pair operation [237](#)
 - splitting pairs [271](#)
 - suspend pair operation [242](#)
 - suspending pairs [275](#)
 - Swap&Freeze option [243](#)
 - system requirements [250](#)
 - troubleshooting [312](#)
 - update copy operation [236](#)
- sidefile threshold [113](#)
- SIMs
 - TC control unit SIMs [191](#)
 - TC device SIMs [191](#)
- specifying
 - VTOC size [433](#)
- splitting
 - pairs using PPRC [297](#)

- SSID
 - adding/deleting for RCU 104
 - requirements for CGROUP 175
- starting
 - LDEV Guard 426
 - Remote Copy monitoring 114
 - TC390 operations 62
- static HPAV 353, 354
- stopping
 - Remote Copy monitoring 114
- Subscriber's choice, HP 21
- Suspend Pair options 132
- suspend type 157
- suspending
 - pairs 132, 275
 - volume pairs 134
- Swap&Freeze option
 - SI390 243
- symbols in text 20
- SYS1.LOGREC 148, 190

T

- TC390
 - components 27
 - control unit SIMs 191
 - data migration 143
 - device SIMs 191
 - disaster recovery 146
 - discontinuing TC390 operations 119
 - displaying pair status information 123
 - error codes 160
 - fibre remote copy connections 58
 - hardware installation 57
 - initial copy operation 35
 - MIH value for 57
 - modes 28
 - optimizing operations 118
 - overview 23
 - preparing for pair operations 120
 - remote copy connections 60
 - remote copy operations 35
 - requirements and restrictions 54
 - sharing volumes with SI390 68, 121, 252
 - software installation 62
 - special write command 35
 - starting operations 62
 - system requirements 53
 - TrueCopy main screen 70
 - volume pair status 46
 - volume pairs 31
- TC390 Asynchronous
 - analyzing consistency of R-VOLs 151
 - control operations 106
 - cylinder bitmaps 51
 - Delete Pair options 138
 - pair options 130
 - performance impact 118
 - point-in-time copy 144
 - recordset operations 38

- Resume Pair options 136
- sidefile threshold 113
- suspend options 133
- suspended pairs 50
- troubleshooting 158
- TC390 pair
 - creating (Add Pair) 126
 - deleting (Delete Pair) 139
 - resuming 136
 - resuming (Resume Pair) 134
 - suspending (Suspend Pair) 132
- TC390 sync
 - performance impact 118
- technical support, HP 21
- text symbols 20
- timeout
 - copy pending 109
 - RCU ready 110
- troubleshooting
 - RCU path status 155
 - SI390 312
 - suspended pairs 157
 - TC390 154
 - TC390A suspension conditions 158
- TSO commands. See PPRC commands

U

- uploading
 - pattern files 432
- using
 - TC390 Synchronous to migrate data 143

V

- viewing
 - consistency group status 107
 - RCU status 91
 - WLM PAV settings 383
- Virtual LVI/LUN 67, 251
- volume pairs
 - changing options 141
 - creating 131
 - deleting 139
 - resuming 136
 - suspending 134
- volumes
 - omitting 123
- VTOC size 433

W

- web sites
 - HP documentation 20
 - HP storage 21
 - HP Subscriber's choice 21
- WLM operation modes 358
- WLM PAV settings 383

X

- XP1024 LCU 369

